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ABSTRACT

Beginning with the decade of the 50's, continuing through the 60's and midway into the 70's, the National Science Foundation, the U.S. Office of Education, and, most recently, the National Institute of Education have become involved in curriculum development on a national basis. The climate of the 1950's and early 60's witnessed the upgrading and updating of the science and mathematics curriculum as well as projects in the social sciences, English, and modern languages, much of which was funded by government agencies. It was the heyday of curriculum development. By the mid-60's, the Great Society Programs had begun, and the focus had shifted from academics and manpower goals to those that served the social needs and soothed the social conscience of the nation. As the decade of the 70's opened, funding for curriculum development declined dramatically as a concerned citizenry and a sensitive Congress began to raise questions and to call for assessment efforts. As the history of curriculum development is traced it becomes evident that influence has been exerted over time by a diverse set of individuals, groups, and interests. The most important identifiable missing pieces from past efforts, however, are carefully designed strategies of curriculum dissemination and implementation, and professional education programs planned specifically to prepare teachers to cope with, make use of, and engage in curriculum innovation. (Author/DS)

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A BRIEF HISTORY OF FEDERAL INVOLVEMENT IN CURRICULUM DEVELOPMENT

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ABSTRACT

Beginning with the decade of the fifties, continuing through the sixties and midway into the seventies, the National Science Foundation (NSF), the U.S. Office of Education (USOE), and, most recently, the National Institute of Education (NIE) have become involved in Curriculum Development. A number of other agencies of the Government have developed curriculum supplements as well.

The climate of the 50's required the upgrading and updating of the science and mathematics curriculum to meet goals of academic excellence and manpower needs. Early in the sixties, projects in social sciences, English and modern languages were also funded. An interagency panel that included representation from NSF, USOE, NASA, AEC, NIH and the President's Science Advisory Committee (PSAC) explored Federal involvement and interagency funding. It was the heyday of Curriculum Development as a variety of innovative projects were proposed by the academic and educational communities and funded by the Government agencies.

By the mid-sixties, the Great Society Programs had begun and the focus had shifted from academics and manpower goals to those that served the social needs and soothed the social conscience of the Nation. Social relevance, values, vocational education and attention to the disadvantaged and handicapped gained prominence. Social science, applied science and mathematics, and career education grew. Interdisciplinary efforts were welcomed.

As the decade of the 70's opened, controversy surrounded the Curriculum Development movement. A concerned citizenry and a sensitive Congress began to raise questions and to call for assessment efforts. Funding for Curriculum Development declined dramatically. USOE transferred its Research and Development Centers and its Regional Laboratories to the fledgling NIE, but continued to fund curriculum through its vocational education programs and discretionary funds. NIE moved to define its role in Curriculum Development while other agencies, interested in a piece of the action, turned to the development of units and modules that could be readily inserted into existing curriculum.

As the history is traced it becomes evident that influence has been exerted over time by a diverse set of individuals, groups and interests, e.g. Congress, the Administration, the Federal Courts, the National Science Board, governmental offices such as the Office of Management of the

Budget (OMB) and the General Accounting Office (GAO), academicians, educators, individuals and groups of liberal, moderate and conservative bent, and the private sector in the form of education-related industries such as publishing, equipment manufacture, media enterprises, testing corporations.

Carefully designed strategies of curriculum dissemination and implementation, and professional education programs planned specifically to prepare teachers to cope with, make use of, and engage in curriculum innovation may be most important identifiable missing pieces from past efforts. The need to authentically involve those who teach and those who make decisions is a lesson to be learned from history. The cyclic nature of the trends and the issues in Curriculum Development is another that merits recognition.

EXECUTIVE SUMMARY

A Brief History of Federal Involvement
in Curriculum Development

by

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In this paper the following questions are addressed: (1) When did the Federal Government get involved in Curriculum Development? (2) What government agencies have supported Curriculum Development over the years? (3) Why and how have they supported Curriculum Development? (4) How does the role of the National Science Foundation (NSF) differ from that of the U.S. Office of Education (USOE), the National Institute of Education (NIE), other units of Health, Education and Welfare (HEW), the National Aeronautics and Space Administration (NASA), or the Energy Research and Development Agency (ERDA), for examples? (5) What has been the reaction to Federal involvement in Curriculum Development on the part of the public? the Congress? academicians? educators? related industries such as educational publishing? (6) What have been the major changes over time in government sponsorship? (7) What principal political forces have been at work? (8) What have been the products of Curriculum Development? (9) How much money is involved?

While some attention is paid to other units, the paper focuses primarily on NSF, USOE, and NIE and at the elementary and secondary school levels. The introduction deals briefly with the early history of Federal involvement in Education through the Morrill Land Grant Act of 1892, the Smith-Hughes Vocational Education Act of 1917, the succeeding vocational education acts, and the basic literacy and language training programs of the Department of Defense during World War II.

In the next section, the spotlight is on Curriculum Development in the decade of the fifties. Following World War II an awareness of the shortcomings of our education system began to develop significantly. In the early fifties, the National Science Foundation was formed as an agency with a dual mission of fostering basic research and education in sciences. Before the decade ended, the Physical Science Study Committee (PSSC), the Chemical Education Materials Study (CHEMS), the Chemical Bond Approach (CBA), the Biological Sciences Curriculum Study (BSCS), and the School Mathematics Study Group (SMSG) Curriculum Development projects were all under way. An urgency was in the air for updating and upgrading a curriculum that had remained essentially untouched for thirty years. The push was for scholastic excellence and to fulfill manpower needs. The swing was away from progressive education and back to academics.

In the late fifties, with the passing of the National Defense Education Act (NDEA), the USOE became deeply involved in disseminating funds to the

states for the purchase of audiovisuals and laboratory equipment to enhance programs in mathematics, science, and foreign languages. Subject matter specialists, representative of the various disciplines taught in the schools and specializing in elementary, secondary or college level programs, had been assembled in OE and were providing curriculum consulting services to the states. Funds were also being channelled into programmed learning and language laboratories associated with an attempt to develop a modern foreign language curriculum.

In the early sixties, NSF moved more strongly into Curriculum Development with a very large number of projects ranging from elementary through secondary levels and across disciplines from science to mathematics to the social sciences with an increasing push for interdisciplinary programs developing. The Office of Education initiated Project English, Project Social Studies and partially funded such projects as Harvard Project Physics (HPP) and the Conceptionally Oriented Program in Elementary Science (COPES). In adjusting to the "Great Society" programs of the mid-sixties USOE phased out the curriculum specialists in subject-matter disciplines. Social relevancy, equal opportunity, civil rights, socioeconomic and special education questions began to dominate thinking in the Office of Education.

During the sixties, other agencies of the government such as the National Aeronautics and Space Administration and the Atomic Energy Commission began to develop mobile units that could move from school to school as

well as curriculum supplements for the use of teachers in enhancing their science programs. Head Start began in the Office of Child Development.

As the decade of the seventies arrived, a backlash against the Federal involvement in Curriculum Development was developing. Conservative groups, in particular, were gathering strength and becoming more vocal in their opposition to the teaching of evolution, sex education, and values in the schools.

The National Institute of Education had now formed and the Regional Laboratories and Research and Development Centers, initiated in OE, moved to NIE to function as Curriculum Development centers across the country. Implementation and dissemination problems became apparent. The National Educational Assessment Program began to report scores in reading and mathematics that were lower than desired and the hue and cry for a return to the basics began. A decline in science enrollment became worrisome, also. As inflation and unemployment grew and the economy stumbled, the work ethic again began to dominate and vocational education got another strong push. Efforts were made to erase race and sex stereotyping from the curriculum as equal opportunities for women and minorities became prominent concerns.

By the middle 1970's, Federal involvement in Curriculum Development at the elementary and secondary level was largely the province of three Government agencies--the National Science Foundation, the U.S. Office of Education and the National Institute for Education. Other agencies such as the Depart-

ment of Defense, the Energy Research and Development Administration, the Agency on Aging, the Child Study Bureau in HEW, Educational Television (ETV) productions such as Sesame Street and NASA's education programs were also having some impact upon the curriculum.

Congress called for assessment of accomplishments to date and for new directions to be identified before further funds for Curriculum Development were to be made available. A whole bevy of investigators went into action to search for answers.

The latter part of the paper is an attempt to interpret history. Among forces that have shaped Curriculum Development are the amounts of funding available, whether there is space in the school curriculum for something new and the dynamic influence of committed and concerned individuals and groups. Commercial interests of publishers and equipment manufacturers influenced policy as did local institutional interests such as textbook selection committees, teacher training institutes, and local curriculum committees. In the Federal Government, all four branches were influential. The Executive through the President's Science Advisory Committee and the Office of Management of the Budget, the Legislative through the deliberations and actions of Congress, the Judicial as the Supreme Court and the Federal Court systems made decisions that influenced Curriculum Development and the informal fourth branch, the Government agencies and bodies such as the Government Accounting Office and the National Science Board. Each of the

government agencies interested in education exerted varying influence on Curriculum Development.

Changes over time are traced, the growth and the decline of the interest of scientists and other academicians in Curriculum Development, a similar growth and decline in funding, the problem of overshooting the mark scholastically, of preparing curriculum too sophisticated for the maturity levels of the students, the lack of long-range planning and financial resources to carry from development through successful implementation stages and one of the most important missing pieces of all, the lack of a teacher education program, perhaps of a new Curriculum Development project, for altering what teachers are learning in order to prepare to teach, are noted. The paper ends with flow charts and diagrams that attempt to summarize the chronology, the projects, the products, and the money spent, with a brief section on emerging efforts and a bibliography.

A BRIEF HISTORY OF FEDERAL INVOLVEMENT IN CURRICULUM DEVELOPMENT

Marjorie Gardner*

When and how did the involvement of the Federal Government in curriculum development begin? Why and how have they supported curriculum development? To what extent has this involvement been direct and to what extent indirect? Are there cycles of activity that seem to repeat? How much money has the Federal Government invested in curriculum development? Is it possible to get an estimate, at least? What has been the impact? What are the products? What are the political forces that have been at work? And what have been the major changes over time in Government sponsorship? How does the role of the National Science Foundation differ from that of USOE and the newly emerging agency, the National Institute of Education (NIE)? To what extent do the functions of these three organizations that have been most active in curriculum development differ from those of the National Aeronautics and Space Administration (NASA), the Office of Child Development (OCD), the National Institutes of Health (NIH), the Department of Defense (DOD),

*With the assistance of Dr. Gilbert Austin of the University of Maryland Baltimore County, and Mr. Joseph Dasbach of the American Association for the Advancement of Science.

the Atomic Energy Commission (AEC), the Energy Resources and Development Agency (ERDA) and the National Endowment for the Humanities (NEH), for example. What has been the public reaction to Federal involvement in curriculum development? What has been the reaction of scientists? other academicians? educators? school-based industries such as publishers, media and equipment manufacturers, etc.? What lessons can we learn from history?

All of these questions are important ones. In the short time available for preparation of this paper, it was possible to complete a partial analysis only and to identify some tentative answers. An in-depth study ultimately should be done. There are valuable lessons in this history, lessons that can be used to guide curriculum development and Federal involvement in the future.

Definitions and Limitations

Some definitions may be stated for the purpose of this paper. Curriculum will be defined as the content, methods, and materials for instruction--that is, what is to be taught, how it is taught, and what materials have been developed for teacher and student use. Development is the process of planning, designing, testing, manufacturing, and distributing the content, the method, and the materials to the education community.

Although the Federal government has been involved in curriculum development work at adult and higher education levels (most notably by the Department of Defense (DOD) during and following World War II) and at the pre-school levels through the Office of Child Development (OCD), in this paper primary attention will be focused on elementary and secondary school levels, kindergarten through twelfth grade. Some attention is devoted to the Executive Branch, the Congress and the Federal Courts, but most is devoted to the "fourth branch" of government, the government agencies. Emphasis will be on Federal involvement in curriculum development through the direct funding of curriculum groups, but some attention will be paid to the role the Federal government has played indirectly through monies channelled to states and from states to local units for curriculum development.

References are readily available that detail the history of the Nationl Science Foundation's educational programs including the entire curriculum development pattern of initiatives, achievements and controversy.[1,2] The Crane report also contains a detailed budget of NSF expenditures for curriculum development and other educational programs for a twenty-five year period. As a result of the controversy that has surrounded NSF in recent years, a sufficient number of interpretive reports have been written so that it is not necessary to go into great detail in this paper. The references are readily available that carry specific information.[3,4]

References are not so readily available on the curriculum development history of the U.S. Office of Education (USOE) or the even newer agency, the National Institute of Education (NIE). In this paper, there will be an effort to run a counterpoint of these three agencies, beginning with the curriculum development work of NSF and USOE during the fifties and sixties, and continuing with the programs of NSF, USOE, and NIE during the seventies as the primary Federal agencies involved in curriculum development.

FEDERAL INVOLVEMENT PRIOR TO THE 50'S

Neither curriculum development nor Federal involvement are new human activities as Kleibard points out.[5] Plato, St. Thomas, Jefferson, and Franklin were curriculum reformers. Two of these men, Jefferson and Franklin, were deeply involved in the formation of the Government of the United States but they are also known for their work in education. Jefferson converted his curriculum dreams into reality through the founding of the University of Virginia, while Benjamin Franklin helped found academies in Philadelphia and was a driving force behind early vocational curricula.

USOE and NEA

The most influential organization in curriculum development during the latter part of the 19th Century was the National Education Association (NEA), a private rather than a Federal agency. The first evidence of direct influence from personnel in the Federal Government comes in the last decade of the 19th Century as William Torrey Harris, a vigorous U.S. Commissioner of Education, appointed in 1889, became an active and influential participant

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in NEA curriculum debates during his term in Federal office.[6] This participation set the pattern for U.S. Commissioners of Education to be actively involved, through NEA, in curriculum development matters and was a harbinger of the role of the U.S. Office of Education and other Federal agencies today.

In 1892, the NEA appointed the Committee of Ten and asked Charles W. Eliot, President of Harvard University, to chair. This Committee was charged with making recommendations regarding college entrance requirements. It, therefore, had a strong impact on the secondary school curriculum which, at that time, served primarily as university preparation. Eliot espoused the idea of an elective system, of the importance of the development of the mind as the central function of schooling, and of the subjects taught being of interest to students--all cornerstones of Federally-funded curriculum development projects in the 1950's, 1960's, and 1970's.

The Committee of Ten published its report in 1893 and recommended that students be given a choice among four courses of study--Classical, Latin-Scientific, Modern Languages and English. This had a distinct effect on opening up options in the curriculum and freeing it from a rigid structure. This enlightened Commission, eighty years ago, also took the position that the primary purpose of a secondary school education was not college preparation, but preparation for life.[7]

The NEA continued to appoint commissions and committees to study the curriculum in which U.S. Commissioner of Education William Torrey Harris and other Commissioners who followed him participated. In 1918, an NEA Committee on Reorganization of Secondary Education published a report entitled "The Cardinal Principles of Secondary Education." This paper, which viewed secondary education as preparation for a full life, called for extensive modification in secondary education and identified seven aims of the secondary school: to educate students in (1) health, (2) command of fundamental processes, (3) worthy home membership, (4) vocation, (5) citizenship, (6) worthy use of leisure, and (7) ethical character.[8] This was published by the Federal Government as a United States Bureau of Education bulletin. Thus, the Federal Government was playing an early role in disseminating information on curriculum.

In 1935 a group within NEA known as the Educational Policies Commission began to be concerned with curriculum development. In 1936 a committee known as the Joint Committee on Curriculum began to function and in 1943, the Association for Supervision and Curriculum Development (ASCD) was formed. The NEA continued to be the dominant agency in curriculum development, through the 1940's and well into the 1950's, when the Federal Government began to become more active.

The September-October, 1976 issue of the NEA journal Today's Education features an article entitled "The Seven Cardinal Principles

Revisited" in which a distinguished panel called together by the NEA as part of their bicentennial program generally reaffirmed the Seven Cardinal Principles as enunciated in 1918 and discussed them in terms of the present.[9] The planning committees included the current U.S. Commissioner of Education, Terrel H. Bell, and other members of the U.S. Office of Education staff.

Smith-Hughes Act: Vocational Education

The Federal Government began to set the stage for entry into curriculum development in another sense in 1917 as Congress passed the Smith-Hughes Act which introduced vocational education into the secondary schools as a major part of the curriculum. Funds were not made directly available for curriculum development projects. Instead, large amounts of financial aid were funnelled to the schools of the Nation upon guarantee that vocational education programs existed and were being actively improved.

Although the Morrill Land Grant Act had been passed by the Congress in 1862 and might be regarded as the first Federal legislation that influenced curriculum, the funds made available there went to college level programs where they stimulated curriculum development in higher education. The first piece of legislation that had impact on the pre-collegiate levels was the Smith-Hughes Act, an act "to provide for the promotion of

vocational education; to provide for cooperation with the states in the promotion of such education in agriculture and the trades and industries; to provide for cooperation with the states in the preparation of teachers in vocational subjects; and to appropriate money and regulate its expenditures."[10]

A Commission on National Aid to Vocational Education had been created by the President in 1914 and this Commission submitted "proposed legislation" to Congress within the same year. However, it was three years later, after extensive work by the National Society for the Promotion of Industrial Education, the U.S. Chamber of Commerce and other interested groups, plus three appeals by President Wilson, before the Smith-Hughes Act of 1917 was passed and adopted by the states.[11] A Federal Board for Vocational Education was created and the U.S. Office of Education took the responsibility for administering the Act. State plans for programs, kinds of schools and equipment, courses of study, methods of teaching, qualifications of teachers, and teacher training programs were all presented to this Federal Board for approval and funding. This Federal Board growing out of the Smith-Hughes Act was influential in approving or disapproving courses of study and new curricula being developed to fill the needs that had been identified in the funding of the Smith-Hughes Act.

After ten years of progress and funding for the Smith-Hughes Act, agricultural and home economics leaders urged Congress to enact new

legislation which would increase the amount of Federal aid to be channelled through the states into the two areas of curriculum. The George-Reed Act of 1929, the George Ellzey Act of 1934, the George-Deen Act of 1936, and the George-Barden Act of 1946 resulted.[12] These were aimed at further development of vocational education in the United States. No money was earmarked specifically for curriculum development, but large appropriations were being channelled to the states for teacher training, salaries, and travel expenses for teachers and purchase of equipment and supplies. State directors of vocational education, who were in essence curriculum consultants, worked with teachers to design the content to be presented in schools and the way in which it would be taught.

Department of Defense

During World War II, it became evident to the Department of Defense that many of the men in the military service lacked basic literacy skills. It also became necessary to educate specialists in the various foreign languages that were required for translation during the wartime period. Specialists went to work, primarily in the Air Force and the Army, to develop new and better ways of teaching intensively and rapidly some of the content and skills needed by service men. This led to the development of program learning manuals, hardware and software for language laboratories, and to new and creative uses of educational technology and the media.

After World War II was concluded, the curriculum work done by the Armed Services was available as a model to the school systems of America. During the late forties and early fifties when there was a general unrest about the schools and the need for educational change, educators frequently looked to the successful intensive learning programs of the Armed Forces for solutions. As a result, it was only natural that when it became possible to initiate curriculum development programs through other agencies of the Federal Government, the Department of Defense would provide some of the models. Department of Defense work had little direct impact on the NSF curriculum development programs, but it did have impact on the Modern Language programs initiated in the U.S. Office of Education. The vocational educators also learned that they could profit from the experience of the Department of Defense and a collaboration developed there in the late forties that continues to the present time.

In curriculum development, the agencies of the Government involved prior to the 1950's were the U.S. Office of Education where the U.S. Commissioner of Education was playing an early role in developing curriculum ideas and policy working in conjunction with NEA, the Congress and USOE through the vocational educational programs and the Department of Defense which had moved strongly into curriculum development during World War II, particularly in the area of programmed learning and systematized instruction to provide basic literacy and language training.

DECADE OF THE FIFTIES

As 1950 rolled around, the school curriculum was not very different than it had been for the past thirty years since the advent of vocational education in the schools. There had been some shift in the direction called "progressive education," but that entailed changing the style of teaching to a permissive mode more than it meant any change in the subject matter or the text and instructional materials. Educators and the public were both beginning to feel very uneasy about the school curriculum, recognizing intuitively that it was long overdue for a change.

When the Russian Sputnik I was launched in 1957, some Americans went into a panic. To quote Postman and Weingartner, "John Dewey was just beginning to get comfortable in his grave when the Russians, of all people, reached down and stuck a spear into his heart...The indictment went something like this: John Dewey was the father and maybe the mother of the Progressive Education movement. Progressive Education was a kind of gooey, precious, romantic philosophy which stressed permissiveness and life adjustment. There was no place in it for rigorous thinking, discipline, or social responsibility."[13] Both Postman and Weingartner[14]

and Kleibard[15] point out that Dewey was badly interpreted and misrepresented. Of all the educational theorists, he had very much championed scholastic rigor, but his ideas had been distorted to the point where that theme had been largely lost.

Vice Admiral Hyman Rickover in the fifties became one of the most vocal critics of the contemporary school.[16] He ferociously denounced the waste of progressive education and urged a return to what he called "basics." A more constructive analyst, James Bryant Conant, made recommendations on curriculum revisions.[17] Other groups and commissions were pushing for academic excellence and for bringing the school curriculum, which had not been revised in many years, up to date.

Earlier work of James Bryant Conant and Vannevar Bush helped lead to legislation that established the NSF in 1950 as an agency of the Federal Government charged "to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences."[18] NSF's initial response to its mandate was the promotion of basic research and the granting of fellowships for graduate education as a means of satisfying its mission of increasing the scientific and technological manpower of the Nation. Soon added were college-level summer institutes where groups of science teachers from higher education institutions could get together during the summer for special seminars. These were designed to bring participants up to date in their subject matter and to introduce them to the latest techniques for research. By 1953, money was being

made available to extend the summer institutes and to bring into them the latest techniques of teaching as well as up-to-date science information.

In the 1950's, NSF personnel recognized that the quality of science teaching in the secondary schools of the Nation was not as good as desired and that high school teachers could profit also by being brought into summer institute programs to upgrade their backgrounds in subject matter and their methods of teaching. A shortage of science and mathematics teachers for the secondary schools existed and there was growing recognition that a strong capable undergraduate and graduate student body depended on students receiving a good basic introduction to science and the inspiration to continue while in the secondary school level.

By 1955, the National Science Board had begun to discuss the possibility of improving the high school science curriculum as well as the standard of teaching. Soon the need for improvements of science curricula was recognized as being as important as teacher training and early identification of science-prone students in maintaining quality science education at all levels.

The 1958 budget was the first in which funds were specifically earmarked for curriculum development as a separate activity of the Education Division of NSF. Quoting from Appendix II of the NSF report, "the improvement of course content and instructional materials had two principal aspects, the development of new curricular materials based

on new concepts and new advances in science and mathematics and the transmission of better course materials (both new and old) to the teachers along with training and their interpretation and use."[19] Training of science and mathematics teachers was to be by institute programs, science faculty fellowships and other specialized efforts. All were focused sharply upon subject matter.

It was accepted that the development of new curricular materials required a major effort if tangible results were to be produced in a reasonable time. Large amounts of materials were to be sifted and evaluated for retention or discard. The judgement of numerous experts in the field under consideration would be required. Because the decisions were of such importance, the Foundation was especially watchful lest its role be misconstrued. The position the Foundation took was of supporting activities of competent persons and groups in carrying out what these experts judge to be needed and proper. The Foundation took pains to avoid specifying or endorsing course content or approach to teaching. These were considered to be properly the province of the education community and the initiative must derive from the academic community.

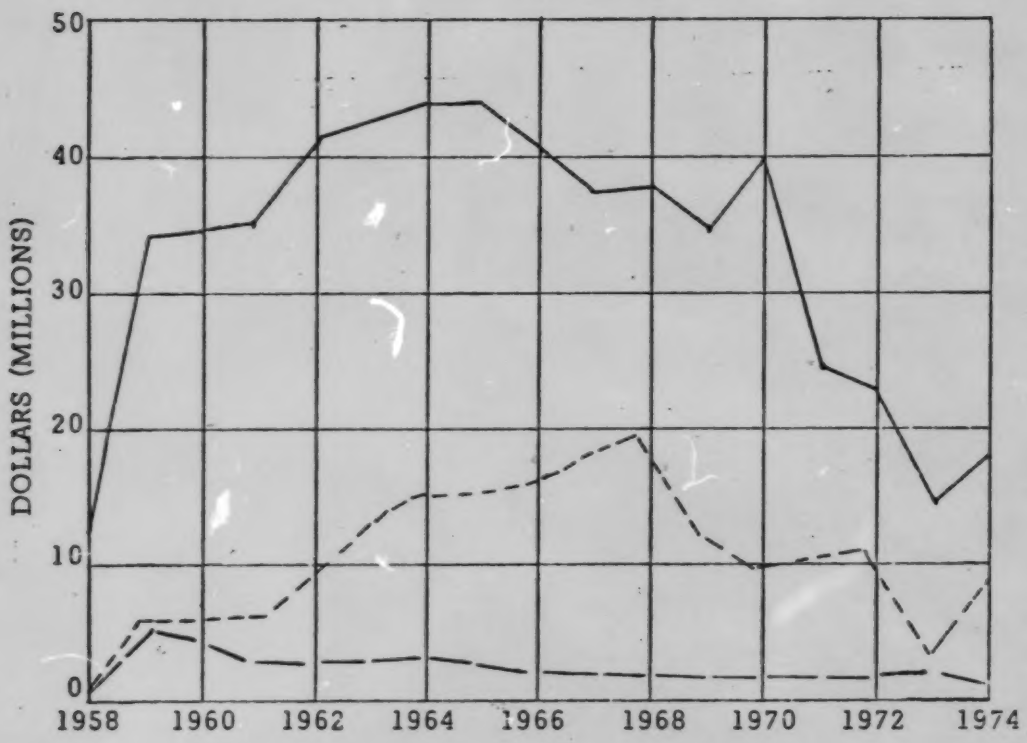
Thus a major new element of Federal sponsorship in education began. The curriculum development work quickly became known to be the "Course Content Improvement Program" of NSF. The period of the fifties initiated a period of evolution as NSF encouraged science educators to

begin to probe, to test, to try to find ways to solve problems that would lead to improvement of science education in the Nation's schools.

One project ultimately funded by the National Science Foundation began as early as 1951. The Carnegie Corporation had provided support to the University of Illinois to undertake revision of the secondary mathematics curriculum in what came to be known as the University of Illinois Committee on School Mathematics (UISCM). Later this program received funding from both the Office of Education and the National Science Foundation.

In the 1957 annual report,[20] NSF officially announced an organizational unit within the Foundation to consider proposals for curriculum development. The special projects in science education staff now had three principal charges: (1) curriculum studies, (2) student participation projects and (3) teacher training projects.[21] Figure 1 illustrates the level of funding at the beginning and through the years.

Figure 1



(Figure Adapted from Nelkin[21])

The NSF Initiates Curriculum Development

Prior to the launching of Sputnik, Gerald Zacharias, Professor of physics at the Massachusetts Institute of Technology, was in Washington on one of his fairly regular visits to the National Science Foundation and, as usual, he paid a call to the Education Office, at that time under the direction of Dr. Harry Kelly. During informal conversation at a coffee break, Zacharias became critical of high school physics and physics teachers. He said that physics was being so poorly taught at the secondary school level that college professors were having to re-teach when students came into their classes. Kelly challenged Zacharias by saying essentially, "If you're correct and the physics teachers don't know physics nor how to teach it and are not up-to-date, then whose fault is it? They learn their physics from you guys in the colleges and universities. What are you going to do about it?"[22]

Zacharias went away and thought this through. Not too long after, he reappeared at the Foundation with a proposal for the development of a new physical science course. This proposal, which was quickly evaluated and approved, became the first venture of the National Science Foundation and the first formal venture of the Federal Government in curriculum development.

The original PSSC effort proposal only involved a film course on physics that would at once update the curriculum and bring high school

teachers in touch with distinguished scientists. In FY 1956, the Foundation granted an award of $300,000,000 for a feasibility study by a committee of physical scientists under Zacharias' leadership. As a result of these meetings, the PSSC committee decided that a film was insufficient and they moved toward a planned student text, film series and set of laboratory exercises.

Zacharias originally envisioned the development of an interdisciplinary course that would bring chemistry and physics together. However, he couldn't find chemists who were interested and willing to cooperate with him and his physics group. Their work quickly evolved into the development of a new physics course for the secondary schools.

Thus, the NSF participation in curriculum development began, not with panels of evaluators, nct with any carefully planned guidelines for funding of curriculum development, but almost by happenstance.[23] As one studies the history of curriculum development, this characteristic seems to be worth examining more carefully: that individuals, dedicated individuals, often change the course of history. In this case, it was Zacharias' drive and Kelly's interest that initiated Federal sponsorship and the development of new curricula for use in the Nation's schools.

Many have wondered why curriculum development under the sponsorship of the Federal Government began at the top of the pre-collegiate ladder with a twelfth grade physics course, rather than with elementary

school science, beginning at the bottom and building up in logical style from there. The answer seems to be in several parts. One is that the move into curriculum development was not pre-planned; it came as an opportunity capitalized upon by an intuitive officer of a Federal agency and a concerned, charismatic physicist. Secondly, since it was a college level academician who examined his conscience and decided that there was a professional and a social obligation to help with the updating and improvement of education in the schools, this physicist and his colleagues felt more comfortable working at a grade level closest to their own experience in preference to starting at the elementary level where they knew very little about young children and about the science they could learn.

Science and mathematics are where the action all began. It might just as well have begun in English, social studies, or in some other area of the curriculum, but it did not. Curriculum development began in secondary science and mathematics. The models for curriculum development, teacher training, and implementation were all set there. Why?

This was the period after World War II when the Nation recognized its need for technical manpower. It was a period when Americans believed that all the problems of the world could be solved by scientists, given enough time, money, and training. This period began at a time when we felt threatened by what appeared to be superior scientific and technological knowledge of our cold war enemy, the USSR. Another reason that it began there is that the scientists and mathematicians tend to be experimenters. Seekers of new knowledge, new processes, new answers, they

are familiar with failure and able to absorb the ego-bruising blows of having to start over again when some experiment doesn't work as originally planned.

Wirt and Quick cite five aspects of the social climate in the 1950's that made this period ripe for curriculum reform. One, a need for scientific and technical manpower to win the cold war generated great public concern for improving education. Two, statements and writings of important figures expressed great disenchantment with the way subjects were being taught in the schools. Three, there was a lingering concern about the poor performance of Army inductees on simple achievement tests during World War II. Four, the flight of Sputnik I symbolized the Nation's problems and catalyzed forces into action. Five, the National Defense Education Act passed in 1958 provided substantial funds for educational improvement in science, mathematics, and foreign language and was the Government's first major education reform initiative.[24]

The first projects to get under way with Federal support were Zacharias' PSSC physics and University of Illinois mathematics under the direction of Max Beberman. Glenn Seaborg, Jr., J. Arthur Campbell and George Pimentel helped to initiate CHEM Study at the University of California with the planning beginning before the fifties ended.[25] Arnold Grobman and Bently Glass set the Biological Sciences Curriculum Study, BSCS, in motion.[26]

USOE and Curriculum Development

During the decade of the fifties, two significant pieces of legislation were passed by the Congress and signed by the President that put the U.S. Office of Education (USOE) into the business of research and development, later to include curriculum development and implementation. The first was the Cooperative Research Act of 1954 which formalized a Federal role in educational research and development for the first time. The second was the National Defense Education Act passed and signed into law in 1958. Title VI of this act called for funding of modern language development programs; Title VII for Research and Development and Title VIII for money to go into the states on a matching fund basis used for the purchase of educational media to include laboratory supplies and equipment. Funds became available through NDEA to be used to implement new curricula being developed under NSF funding.[27]

Education was becoming an increasingly large endeavor in the U.S. society. In the six-year period, 1943-44 to 1949-50, education's share of the Gross National Product rose from 1.8 to 5.1.[28] With expenditures for educational research and development increasing, the U.S. Commissioner, Lawrence Derthick (1956-61), built up a strong group of curriculum specialists in USOE. In fact, by the late 1950's USOE was generally considered to be "home" for the Nation's leading curriculum specialists in science, mathematics, social science and modern language. The states

could call on USOE for assistance in curriculum matters. Specialists were available at the elementary, secondary and higher education levels. These curriculum specialists were resident experts in their particular field of curriculum work and they were frequently called by people at the state and local level to advise them on curriculum problems. Associate Commissioner for Education, Howard Hjelm, who has had a chance to view USOE involvement in curriculum matters for twenty years, suggests that the U.S. Office of Education could be characterized in those days as a University without students. He noted that most of these curriculum specialists did not do much research and development work themselves, but they were very well informed as to what was going on in their field of interest and were, therefore, important resource people to be called upon by educators in the field.[29]

Projects funded under the Cooperative Research Act were primarily attempts at applying educational psychology principles to school programs. They were all field-initiated and the USOE did not establish any priorities. It simply responded to and funded what were considered to be worthwhile projects.

Although Research and Development funds from the National Defense Education Act (NDEA) became available in 1958, the Office of Education did not, in general, fund the development of curriculum, but instead busied itself with providing support for institutes where teachers and scholars

could work together in learning how to use some of the newly created curriculum projects such as PSSC physics and in providing matching funds to the state for the purchase of the films and laboratory equipment. USOE was then and still is very concerned about its image with the public schools. It does not want to be seen as the developer or the promulgator of a national curriculum.

DECADE OF THE SIXTIES

As the decade of the sixties opened, curriculum development work under Federal funding from NSF was in full swing. The PSSC Physics program was being nurtured in Massachusetts, the two chemistry programs, CHEM Study and the Chemical Bond Approach (CBA), were developing at Berkeley and at Earlham College in Indiana, and the Biological Science Curriculum Study was under way in Boulder, Colorado. Each of the projects went through elaborate development processes that brought scientists, educators and classroom teachers together in creative efforts, ordinarily intensified during summer writing conferences. Trial teaching in the schools, often for two or three-year periods, preceded preparation for commercial publication and dissemination.

NSF Extends Curriculum Development

With funding being made available to physics, chemistry and biology curriculum development programs, the question was more urgently raised -- what shall we do about science in the elementary schools? In 1960, NSF funded a series of Feasibility Conferences to be carried out under the direc-

tion of the American Association for the Advancement of Science (AAAS) for the purpose of studying the place and character of elementary and junior high school science and making recommendations about the kinds of projects that should be initiated at these levels. As AAAS queried more than 200 leading scientists, educators and school administrators during the 1960-61 academic year, a strong recommendation for large-scale efforts to develop scientifically sound and economically feasible science programs for students in the first nine grades emerged.

Growing out of the AAAS conference were three major elementary science curriculum projects that all received NSF funding. One was Science, A Process Approach (SAPA) developed under the auspices of the Science Education Commission and the Education Office of AAAS with Dr. John Mayor directing. Specialists in elementary school science, mathematics and learning theory began work at the University of Maryland in 1962 to develop a new integrated science-math program for grades K-6 based on learning hierarchies and behavioral objectives. Another was the Elementary Science Study (ESS) that was housed in the Boston area in the same facility with the PSSC physics team. This unit or modular approach, sometimes called "messing about in science" was greatly influenced by Jerome Bruner, a Harvard psychologist, and David Hawkins, a University of Colorado philosopher, who enunciated the learning theories. About the same time, Robert Karplus, a physicist from the University of California

at Berkeley who was on sabbatical leave at the University of Maryland, began to put together his ideas for an elementary school science program for grades K-6. The large majority of the work on the Science Curriculum Improvement Study (SCIS) was done after his return to the University of California. A set of physical science and a set of biological science units evolved.

As the elementary projects got under way in the early 60's, it became apparent that the junior high school years, grades 7-9, were the neglected area of the science and mathematics curriculum reform movement. A number of junior high school proposals for curriculum development were funded and several of these became major programs with the development of new texts, teachers' guides, laboratory equipment, and audio-visual materials.

Under the auspices of the American Geological Institute, the Earth Science Curriculum Project (ESCP) became one of the first efforts to develop an interdisciplinary program. The writing teams under the leadership of Robert Heller from the University of Minnesota were composed of geologists, oceanographers, meteorologists, astronomers, geochemists, physical geographers, science educators and classroom teachers. ESCP was also the first program at the secondary school level to integrate laboratory work into the text and to move strongly to an inquiry style through illustrations that required interpretations and answers to questions.

The same group that developed PSSC physics now turned their attention to the junior high school level and achieved their original goal of bringing the physical sciences together into an integrated course. The Introductory Physical Science (IPS) Program, heavily lab-oriented, was directed by Uri Haber Schaim and developed by the Educational Development Corporation of Newton, Massachusetts.

Three smaller projects for elementary or junior high school level developed in the form of the Illinois Astronomy program, the "Time, Space and Matter" program at Princeton, and the Minnemast effort to investigate mathematics and science at the University of Minnesota.

The "new math" was already developing rapidly in the School Mathematics Study Group (SMSG) program at Stanford University, the University of Illinois Committee on School Mathematics (UICSM) and the Madison project initiated at Syracuse University. Stirrings were also evident in the social sciences as curriculum developers now began to present proposals to the National Science Foundation for projects in high school geography, anthropology, and economics. One, "Man, A Course of Study (MACOS)," was later to lead to national controversy and to a temporary, at least, suspension of curriculum development through NSF.

Case studies of five selected projects - CHEM study, SCIS, Comparing Political Experiences (CPE), MACOS, and a relatively new project, Individualized Science Instructional Systems (ISIS), are included in a

recent NSF study.[30] Some of the projects have also written detailed histories of their work. Two examples are The CHEM Study Story[31] and Elementary Science Study: A History.[32]

In 1962 the National Science Foundation began to publish detailed reports on NSF-funded curriculum projects in the form of brochures entitled "Science Course Improvement Projects."[33] These were designed to disseminate information on the projects to schools that might be interested in making use of them. The first brochure, as well as subsequent revisions, contained the following paragraph in the forward: "The purpose of this booklet is to help make information widely available on science improvement projects supported by the National Science Foundation. Decisions on what to teach remain in the healthy American tradition an exclusive responsibility of individual schools and teachers. The National Science Foundation does not recommend the adoption of any specific book, film, piece of apparatus, course or curriculum. It is hoped, however, that the products of these projects will prove to merit serious consideration in every school and college."[34]

In addition to publishing their own booklets on projects, the National Science Foundation began in 1962 to fund, through a grant to the AAAS, a series of reports published annually and then bi-annually by the University of Maryland's Science Teaching Center.[35] The Clearinghouse Report, as it came to be known, was national in scope in its first editions and

then became an international publication reporting on science and mathematics curriculum development with projects throughout the world. A summary edition of ten years of the publication appeared in 1974.[36]

Bowen Dees and Charles Whitmore, of the NSF education staff, wrote a history of the early NSF years in education that was published in School Science Review in the Spring of 1962.[37] In 1965, the Education Divisions prepared an extensive document entitled "Status Report on the Course Content Improvement Activities of the National Science Foundation"[38] for the Daddario Committee of Congress. This document provides a comprehensive overview of course content improvement programs for the first decade of activity.

In 1969, the National Science Board requested the Advisory Committee for Science Education of NSF to evaluate the effectiveness of the Foundation's programs in science education. In particular, they were interested in the course content improvement activities (curriculum development work) and requested recommendations for the decade of the seventies.[39]

As curriculum projects developed in the sixties, the question of publication of materials developed. The original intent of the early developers was to prepare a manuscript to throw on the open market for any publisher or manufacturer who wished to produce the textbook. Foundation officials originally thought that to be a fine idea, but it did not work. No publisher would touch it. They said unless we can get an exclusive right, for a

limited period of years, at least, we can spend large amounts of money to produce the textbook; we can put it on the market; we can advertise it; we can promote it in sales campaigns, and when we get a market developed, then others will walk right in and take the same materials and undercut all of our efforts. So economically, they said, we can't touch it unless we have an exclusive until our investment is returned. That fact of life materially shaped the Foundation's policy with respect to the publication of projects funded by the NSF.[40]

The Foundation eventually developed a publication policy that was approved by the National Science Board. It said when the work is nearing or is essentially completed, any publishing firm shall be given a right to bid on the publication and on any related materials. The successful bidder will be given a limited exclusive (5 - 7 years, typically).

At that point, the Foundation again had to face a serious policy question. Inasmuch as the Federal Government had underwritten virtually the total expense of developing and testing the new program, the work could be put on the market commercially at a cost substantially less than if it had been developed otherwise. Should the Foundation permit these new materials to be placed on the market at a substantially reduced cost, and therefore, create havoc within the publishing world? Or should the Foundation insist the materials be sold at fair trade costs, and allow the publisher, presumably, to make an undue profit? Out of that dilemma grew

another NSF policy decision. Too much damage would be done to the publishing industry if a publisher should, by virtue of government support, be allowed an undue financial profit. Therefore, anything regarded as excess or undue profit should be returned to the government.[41]

In a major policy decision, commercial publishers were encouraged to participate in the new curriculum movement and agreements were signed during the sixties for each of the major curriculum projects funded under grants from the National Science Foundation. The first, for PSSC physics, went to D.C. Heath Publishing in 1960. The second was to McGraw-Hill Book Company to publish the Chemical Bond Approach Program while W. H. Freeman Company was selected by CHEM Study. The Biological Science Curriculum Study arranged contracts in 1963 and 1964 with three companies, Houghton Mifflin, Rand McNally, and Harcourt, Brace and World Company to publish the "blue," "green," and "yellow" versions of BSCS.

In 1966, the first social science project was ready for publication and the McMillan Company became the publisher of the Anthropology Curriculum Study Project, ACSP, developed under the auspices of the American Anthropological Society. In 1967, publishing contracts were awarded to Xerox Corporation for the extensive K-6 Science, A Process Approach (SAPA) program developed under the auspices of AAAS. These few examples will suffice to indicate the range of publishing companies that became partners in the federally funded projects.

NSF's decision to allow commercial publication of the federally-funded projects was a policy decision that had wide-ranging implications. The tri-partite collaboration of the Federal Government, the business world and academic world unleashed an array of forces that helped to shape the new curriculum. Officials of the American Textbook Institute assisted by soliciting expressions of interest from publishers and by participating with the NSF staff and curriculum developers in setting policy guidelines. A wide range of commercial companies that included textbook and trade book publishers, film makers, and equipment manufacturers became involved. These publication policy guidelines evolved through several stages from a memorandum from the NSF director, Dr. Alan Waterman, in 1960, to a published document approved by the National Science Board for distribution in 1969.[42]

The NSF decision to allow publishers an exclusive for a period of years resulted in wide interest in the publishing industry and in attractive professional preparation, publication and dissemination of NSF-funded projects. That this was a vitally important decision is evidenced by the fact that, a little later, the Office of Education decided to place curriculum materials developed under their funding into public domain. No commercial publisher would touch them and, as a consequence, the curriculum materials from Project English, Project Social Studies, and the modern language program were never published and disseminated successfully for general use across the country.

The National Science Board, an advisory and policy-making unit composed of eminent scientists, first became involved in approving educational programs in 1955, when a budget for science education was submitted that recommended an allocation for science curriculum and teacher training.[43] At that time, the Board asked that primary consideration be given to the improvement of high school science curricula. During the next several years, NSF reviewed a number of proposals that related to curriculum development.

Although the National Science Board was always a bit uneasy about the Foundation's role in curriculum development, they continued, during the sixties, to approve grants for the projects presented to them, including MACOS, the social science project that would later bring the wrath of a conservative constituency down on their heads. The Board's discomfiture about the Foundation's involvement in educational activities of any sort, most particularly in curriculum development, was apparently related to its composition. Being composed mainly of scientists, there was a reluctance to channel money into education activities which were considered to be secondary. Uncertainty about the place of education in NSF was relatively strong. Members of the education staff of the Foundation were frequently placed in the position of justifying programs to the Board. Temporarily satisfied, in six months the Board would again be questioning the involvement of the Foundation in curriculum development.

The Director of the National Science Foundation in the early sixties, Dr. Alan Waterman, strongly supported and encouraged the Foundation's role in curriculum development. Support from Congress and the Executive branch of the government were relatively generous during this period.

The decade of the sixties was the heyday of curriculum development under NSF funding. Some of the most eminent academicians and educators of the Nation teamed together to produce science, mathematics, and social science curricula. They found satisfaction and excitement in this creative endeavor. Content was updated. New formats that were more student-centered began to develop in the instructional materials. Educational technology was explored as a medium for instruction. The "inquiry" or "discovery" approaches to teaching were incorporated into the new materials. This was a time of innovation and experimentation. New curricula were developed, trial taught, revised, and prepared for publication.

As the curriculum development projects progressed, many more policy decisions had to be made. Could a developing group stay in "business" forever? Or must they close when they had finished what they initially set out to do? If excess profit money from the publishers were to be funnelled directly back into the U.S. Treasury, then how could curriculum projects be funded to handle residual business after their main thrust was over? These and other difficult questions occupied a prominent place in NSF planning during the 1960's.

In the early 60's, a guiding principle was that while NSF would support research and development on the substance of courses and the tools of instruction, Foundation funds were not to be used to promote the adoption of any specific curriculum, course or instructional materials. The new products were expected to be good enough to compete on their own merits. Each school system and teacher must be free to decide if and how to use the products developed.

It soon became evident that this was a noble idea but that new curricula would not be accepted spontaneously. A basis for orientation and decision-making by teachers and school administrators was needed. Therefore, the NSF was directed to begin curriculum implementation programs. These took a number of forms such as cooperative college-school teacher training programs, leadership conferences, and information dissemination programs for school administrators.[44]

The Nation's schools did not welcome the new curricula with open arms, for several reasons, perhaps. One was a reluctance to participate in what might become a "national curriculum." Two, teachers became uneasy about new programs for which they had little training; some held an actual fear of science and of using hands-on materials. Three, school system administrators were concerned about parental reaction and about the cost of programs that required audiovisuals and equipment in addition to the traditional textbook. Four, a hue and cry began to be

raised by elements of the citizenry who objected to the teaching of some of the curriculum content, e.g. evolution, human reproduction, and human values in the school.

In the second half of the 60's, a discordance of contradictory voices began to arise. Among these were the liberals versus the conservatives and the Congress versus the Office of Management of the Budget (OMB). Others suggested that USOE, not NSF, should be the lead agency in curriculum development. All influenced curriculum development in the sixties. Concern increased as the decade drew to a close.

Even during the period of greatest growth and stability, 1960 - 1965, Congress, while generally enthusiastic and supportive of curriculum development, began to ask questions about the management of curriculum development.[45] For example, in 1962, they initiated inquiries into the cost of curriculum development, publishing arrangements, and new programs being developed. By 1965, Congress was beginning to show concern about the growth of the science budgets, and about feedback from the field with respect to controversial material in curriculum projects.

In 1967, the science education budget leveled and began to decline, a decline that has continued from that time until this, growing evermore dramatic.[46] The budget decrease came from at least three sources: One was Congress' questioning of the size of the NSF budget; another was the interest of NSF management and the National Science Board in

maintaining a high level of funding for scientific research and cutting the level of education funding to do so. A third factor that led to decline in the education budget was the loss of a powerful friend of curriculum development. The Interagency Panel on Educational Research and Development came apart at the seams when most of the original members of the group left Washington in 1964. Alan Waterman of NSF, Glenn Seaborg of AEC, James Webb of NASA, Sterling McMurrin of USOE and Jerome Weisner, the President's science advisor, had worked together to monitor and encourage curriculum development and to help make decisions about Federal agency involvement.[47] When these men left Washington, and new leaders took over their posts, curriculum development and the role of the Federal Government agencies in curricular development was not so high among the priorities of the new agency leaders and cooperation faded.

The U.S. Office of Education Role

Several pieces of legislation passed by Congress in the late fifties and sixties had a major influence on USOE activity in curriculum development. The first was the National Defense Education Act of 1958 which, under U.S. Commissioner Lawrence Derthick, put USOE into curriculum development in modern language. This also opened the door for Sterling McMurrin as U.S. Commissioner in the early 60's to extend curriculum development funding from USOE to English and the social sciences using

both the National Defense Education Act and the Cooperative Research Act authorization and funding.[48]

Dr. McMurrin, Vice President of the University of Utah prior to being named Commissioner of Education, had gained experience with the NSF science education programs through teacher institutes that operated on the University of Utah campus. He was impressed with the drive for academic excellence and one of his first actions upon accepting the position of U.S. Commissioner of Education was to encourage USOE participation in curriculum development in areas other than science and mathematics, which he deemed were being well served by NSF.

In the first weeks of his term as U.S. Commissioner, McMurrin was contacted by the Bureau of the Budget with the information that President Kennedy wished to increase the budget for education to some degree for the balance of 1961 and even more for 1962. McMurrin was asked what area needed money most. He responded that any extra money should go into curriculum development in the non-scientific areas. He was aware that the Office of Education was already involved in modern language curriculum development to some extent under NDEA and, being impressed by NSF's success in curriculum development, he wished to use their models to build a curriculum development effort in USOE for other academic areas.

The National Council of Teachers of English had just published a report that highlighted the miserable condition of English teaching.

McMurrin was impressed by the report. It seemed responsible, and he thought that English would be a good place to initiate curriculum development work. Hence, Project English was funded and later, it was followed by Project Social Studies. Since both had been preceded by the modern language program, this meant that USOE was moving in three academic areas in curriculum development.

Hence, in the early sixties, USOE also became engaged in curriculum development for the academic areas. Not only were new instructional materials being developed, but excitement was high on the part of the Office of Education curriculum specialists, the resident experts, whose advice was eagerly sought by state and local systems. This was also the time of interagency cooperation and joint funding looked like a real possibility.

Soon, however, Commissioner McMurrin was running into difficulty in funding curriculum development work through USOE. The opposition came from within the education community, particularly from educational psychologists who were more interested in research than development. Their concern was that hard-won funds for educational research might be diverted into curriculum development.

McMurrin had not the slightest intention of diverting funds from research. The USOE was receiving additional money that was going into curriculum development; none was being taken from the research budget.

In fact, during McMurrin's first year in office, the research budget rose from $6 million to $13 million. But the fear that research might be replaced by curriculum development was the driving force that led to a national ruckus among educational researchers, and a great deal of damage was done to the USOE curriculum development move before they realized that research funds were not in jeopardy.

Another difficulty developed when it came time to tackle the question of publication of the materials developed under USOE funding. McMurrin favored following the NSF example and giving commercial publishers a limited exclusive. Others in USOE favored declaring any USOE-funded curriculum materials to be freely available to all who were interested in dissemination. When Francis Keppel became Commissioner, the latter forces won the debate and USOE-funded materials went into public domain. As a result, publishers were not interested in these materials, since they had no guarantee of recovering their investment.

This policy decision hampered the USOE curriculum development thrust since the materials designed under their funding never became generally available to schools in their innovative format. More recently, as will be discussed later, USOE has moved to a policy stance similar to that of NSF. They now permit limited exclusives on publications recognizing the need to work cooperatively with the publishing industry in order to maintain the integrity of new materials and to disseminate successfully the fruits of curricular efforts.

An Era of Interagency Cooperation

Early in the sixties, Zacharias of MIT and Jerome Bruner of Harvard urged McMurrin to consider more involvement of USOE in curriculum development and the possibility of joint funding with NSF of further work in science and mathematics. The idea of an interagency panel representing all government agencies that might have both interest in and funds available for curriculum development began to evolve.

At that time, Alan Waterman, the Director of NSF; McMurrin of USOE; Jerome Wiesner, the President's Science Advisor and Chairman of the President's Science Advisory Council (PSAC); Glenn Seaborg, Chairman of the Atomic Energy Commission (AEC); and James Webb, Director of the National Aeronautics and Space Administration (NASA) were all interested in curriculum development. Both Seaborg and Webb were exploring how their agencies might participate in educational programs, while NSF and OE were trying to define their own policies in curriculum development. Shannon, the Director of the National Institutes of Health, was also trying to evaluate what the NIH role might be.

Therefore, it was proposed that the agency heads meet to consider the role of Federal agencies in curriculum development and the possibilities for cooperation and joint funding. A clause in one of the legislative acts that put USOE into curriculum development provided an opening for the Commissioner of Education to take the initiative in bringing agencies

together. McMurrin chaired the first interagency committee with Waterman of NSF, Webb of NASA, Shannon of NIH, Wiesner of PSAC, Seaborg of AEC as participants. Zacharias served in a consultative role. The Panel's goals were to discuss the problems of Federal agency correlation and to see that curriculum development work or other activities that were educational were well done, and to prevent wasted time, motion, money, or unnecessary duplication. They aimed for efficiency, for quality, and for making Federal money go further through joint funding.[50]

In 1961, the Committee for Interagency Cooperation decided to establish a Panel on Educational Research and Development to operate under the auspices of the President's Science Advisory Committee. The panel was to report to the U.S. Commissioner of Education, the Director of the National Science Foundation, and the Special Assistant to the President for Science and Technology. Gerald Zacharias of MIT was named chairman, and the members of the panel were drawn from a variety of backgrounds that included public and private schools, colleges and universities, state and Federal agencies, and other institutions associated with education.

In March of 1964, this panel reported progress in a pamphlet entitled "Innovation and Experimentation in Education."[51] But the principals in the interagency committee had changed. Francis Keppel was now U.S. Commissioner of Education, Leland Haworth directed the National Science Foundation and Donald F. Hornig had become Special Assistant to the

President for Science and Technology. The change in agency leadership had a significant effect on the work of the panel. The original interagency committee held a high and enthusiastic interest in cooperation and the promotion of educational innovation and experiment. The new leaders of these Federal agencies had other priorities and the report of the interagency panel appears to have gone almost unused and unnoticed.

It was during this time of interagency cooperation that USOE and NSF jointly funded two curriculum projects: Harvard Project Physics (now known as Project Physics) developed by Gerald Holton, Fletcher Watson and James Rutherford of Harvard University and the Conceptually Oriented Project in Elementary Science (COPES) proposed by Morris Shamos and Darrell Barnard of New York University. The well-established Biological Sciences Curriculum Study (BSCS) successfully sought USOE funds to help finance an extension of their program directed toward the disadvantaged. But this promising beginning for interagency cooperation and joint funding ended in the 60's almost as soon as it began. Lyndon Johnson, with his great society ideas, became President and appointed a U.S. Commissioner, Francis Keppel, who strongly felt the necessity of providing a better education for the disadvantaged minority populations to redress grievances arising from their long neglect in the U.S. culture. The focus of USOE began to shift away from the academic areas and toward programs for the handicapped, the minorities, the low socio-economic levels, and the populations of the cities.

USOE Reorganizes

In the mid-sixties, Commissioner Keppel began a reorganization of USOE directed toward fulfilling what he and others saw as the agency's social role. One of the significant developments in this reorganization was the phasing out of the curriculum consultants, the subject matter specialists.

As an example of the transitional steps that occurred, an engineer was brought in to take charge of the science education group and to orient its efforts more toward career and vocational education. Since this was neither the interest nor the area of expertise for most of the members of the science education group, they chose to (1) retire, (2) seek positions outside USOE, or (3) move to other areas of the Office of Education where they became generalists. In a very short time, the science education no longer existed. This was true for the other academic areas as well.

One insightful paper that was commissioned by USOE and reported in 1966 under the title "The Office of Education and Strategies for Curriculum Improvement" never saw the light of day in permanent form.[52] Yet a paragraph from Gideonse's paper clearly defines some of the problems of the time:

> "Improvement of curricula in the Nation's school is an exceedingly complicated business. It must involve many different kinds of competencies and interests. It must concern itself with both the short-term and long-term consequences of Federal involvement. It may turn out, for example, that the fact of Federal activity in this area may

> ultimately be of more significance than the specific nature of any given curricula that happens to be improved. The role of teachers, university scholars, media men, school administrators, and the lay public is variable and, oftimes, an inordinately sensitive matter. Concern must be directed to the diffusion of new materials even before their preparation begins since highly innovative materials might well turn out to be non-usable because of insufficient attention at the beginning to the problems of meaningfully disseminating knowledge about materials to a professional group numbering nearly two million. We must know, in short, why we are supporting the development of such materials and what the possible impact of our activities can be upon the school. This paper attempts to raise issues without trying to solve them. It constitutes an agenda and it comprises an analysis of the problem only in the sense it tries to raise all of the related issues."[53]

Then Gideonse establishes six premises for USOE involvement in curriculum development:

> (1) All of USOE's activities in this area will be conducted so as to preserve and enhance local control and responsibility for education. (2) All final versions of curriculum materials produced under contract or grant from USOE must enter the public domain. (3) The analysis of strategies of curriculum development is broader than the consideration of what the objectives of new curriculum ought to be, but it certainly includes such considerations. (4) The Office of Education is only one of several agencies heavily engaged in the development of curriculum materials; however, it is in the balance-wheel position, able to fund what others do not do including additional curriculum efforts in order to preserve options for local agencies. (5) Large-scale curriculum development efforts as pioneered at the Federal level by the National Science Foundation do create widespread pressures in local communities for adoption and tend therefore to be "successful." (6) The discussions of the issues which follow need to be conducted.[54]

Prior to identifying the issues, Gideonse points out that sooner or later decisions on USOE's stance on issues will have to be made. One possible option is a completely laissez-faire attitude in which decisions on issues are made by those who propose rather than USOE. The other is for the Office of Education to take a stand on issues. He then states the curriculum development issues as follows:

> (1) Offensive versus defensive strategies. Should we build improved curricula for the schools as they are, or should we build them for schools as the very best minds we can assemble say they should be? (2) Who sets the objectives? Who decides what should be taught, both in terms of substance and process. Should the academician or the educator or the public set these goals or should they be shared among all? (3) Who should build the curriculum? What is the proper mix of people who need to be involved in curriculum development? (4) Full-course development versus discrete unit approach. (5) Short-term effects versus long-term consequences. (6) The role of private industry in curriculum development. (7) What difference does educational level make? Should identical strategies be adopted for developing curricula for pre-school, elementary, secondary, higher, adult, or extra school education programs? (8) Deliberately engineered fringe benefits. To what degree should curriculum development be closely interwoven with pre- and in-service education? Or with team teaching? Or with individualized learning? (9) Curriculum building and the problem of diffusion. How will these materials be diffused into the schools? Does a mechanism exist or can one be created that is commensurate to the task? (10) How do new programs relate to existing programs? What impact will curriculum development have on similar activities already under way in the laboratories and R & D centers? What relationship should there be between new USOE curriculum efforts and existing programs at the National Science Foundation, through private foundations or in vocational education? (11) Outlandish models. Should USOE help set models for imaginative new ideas that vary greatly from the conventional programs?[55]

The Gideonse Report raised many interesting questions, but it appears that the report was largely ignored as USOE moved away from direct involvement in curriculum development. That responsibility was placed in the hands of regional centers and laboratories, as the headquarters in Washington went on about other business.

National Centers for Educational Research and Development

By the mid-60's, it became increasingly apparent that major new curriculum revisions would require enormous amounts of time, energy, and money. The U.S. Office of Education with its data collecting and funding responsibilities and its new social directions was not in a position to manage such enterprises. The response by USOE was to issue a series of requests for proposals that would establish two new kinds of institutions: Education Laboratories and Research and Development Centers. In the early 1960's, John Gardner, as Secretary of Health, Education and Welfare, had set up a task force to report to him on HEW's and USOE's role in education. One of the recommendations made by this task force, as they reported in 1964, was to institutionalize curriculum development by creating a series of regional education laboratories. Compared with the NSF-supported curriculum development, projects to be supported by the regional laboratories would (1) be primarily in subject matter areas other than sciences and mathematics, and (2) be

developed by the permanent staff of the laboratories rather than by temporary teams of developers.

In 1965, the National Center for Education Research and Development (NCERD) was created as a part of the reorganization that took place in USOE after the passing of the massive Elementary and Secondary Education Act (ESEA).

With ESEA in 1965, funds became available for additional university-based research and development centers and for the initiation of a new entity, the regional laboratories. The creation of laboratories and R & D centers was recommended by a group of experts assembled by President Johnson. Cronback of Stanford University and Cremins of Teachers College, Columbia University served as chairmen. Cremins was particularly interested in the curriculum development possibilities of the laboratories and R & D centers.

Late in August of 1965, USOE issued guidelines for the creation of a group of laboratories and centers that, as one of their responsibilities, would research, develop and disseminate curriculum materials that could be used by a variety of school systems. In February of 1966, twenty laboratories were either in operation or under development. In addition, nine university research and development centers had been created. Two of these had been in operation from as early as 1964 and the other seven were created and funded under Title V of ESEA.

No sooner had the twenty laboratories and the nine research and development centers been established than criticism began to be voiced by the education community to Congress and to the U.S. Office of Education about these units. In response, the U.S. Commissioner of Education, Harold Howe, requested Francie Chase of the University of Chicago to do a study of the laboratories and the R & D centers. The first report, issued in December of 1968, was entitled "A National Program of Educational Laboratories."[56] The next one, published in April of 1971, was entitled "A Mixed Report Card."[57] There were a number of short interim reports in between.

It had become quickly apparent that it was much easier to talk about creating educational laboratories and research and development centers than to actually do this in a way that was effective. Congress, to satisfy its constituency, wanted quick results to show the people. The laboratories and R & D centers, that had begun with high hopes, soon ran into troubled waters.

It is beyond the scope of this paper to attempt to document all the problems and difficulties that the laboratories, and to a lesser degree, the R & D centers encountered, but some should be identified. USOE was now heavily engaged in dispensing funds to state and local agencies and it could not provide the necessary leadership and coordination for these new units. There were problems in attracting innovative and highly

qualified staff. Setting priorities, building bridges to the local educational systems, and the much greater difficulty of creating, testing, evaluating, and disseminating new educational materials were major hurdles encountered.

Insecurity about continued funding was another factor that has been a continuing problem for units and programs associated with USOE. Frequent reorganizations and the termination of projects, truncated before they had been able to demonstrate their effectiveness, have given USOE an image of a start and stop agency that is either not farsighted enough or courageous enough to carry through on long-range research and development projects.

A little later, recognition of these persistent problems led to the creation of a new agency for educational research and development, the National Institute of Education (NIE) and the NCERD units were moved to this new, hopefully, action-oriented agency.

Vocational Education Through OE

Vocational education, as administered by the U.S. Office of Education, is quite different from other programs in the area of curriculum development such as those under NDEA or ESEA legislation. This is due to a long history of Federal involvement with state and local education, business, labor, and industry groups beginning in 1917 with Smith-Hughes Act. The

Federal Government has, for many years, been giving large sumes of money to state and local governments to foster development in vocational education. A working partnership has evolved over a long period of time and it extends beyond the walls of the school.

Vocational education curriculum workers have, to some degree, used the model developed by the Agricultural County Agent and the same feeling of cooperation exists between education groups on the Federal, state and local level that exists between similar groups in agriculture. They have also attempted to follow the county agent's pattern in the sense of funding "lighthouse" or exemplary curriculum efforts in the hope that these will be adapted and modified to local needs.

By 1961, President John F. Kennedy had requested the Secretary of HEW to convene an advisory body for the purpose of reviewing and evaluating the current National Vocational Education Act and making recommendations for change. The results was reported in November, 1962, by the consultants who recommended a large increase in the Federal contribution for vocational education. This led to the passage and signing of the Vocational Education Act of 1963.[58] The purpose of this new act was to authorize grants to maintain, extend, and improve existing programs; to develop new programs, and to provide part-time employment for youth who need earnings to continue training.

The 1963 Act also provided for the appointment of an Advisory Council

on Vocational Education. It was the study of this council that provided background data for the Vocational Education Amendments of 1968. The 1968 amendment is considered to be one of the most important developments in vocational education since the passage of the original Smith-Hughes Act. It shifted program emphasis from limited occupational categories to include major new groups of people in need of training. The purpose of the Vocational Amendment Act of 1968 was vocational training for all. This provided a liberating influence on vocational education, making it a part of the general education curriculum and available to every student.

It is in the language of the Amendment Act of 1968 that the term, curriculum development, first specifically appears. However, curriculum development had long been practiced by vocational educators using funds from the Federal Government under earlier acts.

The 1968 Amendments also established a national council composed of 21 members appointed by the President and required to meet quarterly and report annually to the President. The Federal Government was assuming a larger and more centralized role in vocational education. This Act also included discretionary funding authority through which the Commissioner of Education could make grants or contracts with colleges or universities, state boards, and other agencies to do curriculum development work. To quote directly from the Amendments of 1968, Part I, Curriculum Development in Vocational and Technical Education, Section 191:

> "The Congress finds that curriculum development in vocational education is complicated by the diversity of occupational objectives; variations due to geography; differences in educational level and types of programs; and by the wide range of occupations which includes, but is not limited to, agriculture, food processing and preparation, trades and industries, distribution and marketing, technical, public service, health services, business and office occupations. It is therefore the purpose of this section to enable the Commissioner to provide appropriate assistance to state and local education agencies in the development of curriculum for new and changing occupations and to coordinate improvement in the dissemination of existing curriculum material"[59]

Quoting again from Section 191C:

> "Sums appropriated shall be used by the Commissioner, after consultation with the appropriate state agencies and national councils, to make grants to or contracts with colleges or universities, state boards, and other public or non-profit private agencies and institutions (a) to promote the development and dissemination of vocational education curriculum materials for use in teaching occupational subjects, including curriculum for new and changing occupational fields; (b) to develop standards for curriculum development in all occupational fields; (c) to coordinate efforts of the states in the preparation of curriculum materials and to prepare current lists of curriculum materials available in all occupational fields; (d) to survey curriculum materials produced by other agencies in the Government including the Department of Defense; (e) to evaluate the vocational-technical education materials and their use; and (f) to train personnel in curriculum development."[60]

This very broad mandate for Federal involvement in curriculum development in all of the areas of vocational education defines curriculum materials to mean "materials consisting of a series of courses to cover instruction in any occupational field in vocational education designed to prepare people for employment at the entry level or to upgrade occupational competencies of those previously or presently employed in any occupational field."[61]

The vocational education group funded a number of curriculum centers around the country which created dissemination units of their own during the sixties. One example is the Consortium of the States working on curricula and criterion-referenced tests and operating primarily in the Southern region of the United States. Another group, the Mid-American Consortium, is developing relatively specific curriculum for the Dakotas and Texas.

In 1968, a new responsibility to create vocational education curriculum for the handicapped began. The vocational education unit in the Office of Education now began funding curriculum projects in this area as well as in bilingual vocational education.

A variety of forces have interacted with one another to shape vocational education in the United States through the years. McGrath and Johnson single out four for special attention: (1) the tradition of humanitarianism in American life; (2) a pervading faith in the utility of education in solving individual and social problems; (3) the development of the landgrant college as a means of higher education; (4) the philosophy of egalitarianism that led to the emancipation of women and to their education.[62]

Funds were sought for home economics as a means of emancipating women and of providing them an opportunity to share in the educational enterprise. Agricultural and industrial education were for the boys. Home economics was for the girls. But that picture has changed as the U.S.

has become more conscious of sex stereotyping and of providing equal opportunities for members of the population of both sexes. By the late 60's, one of vocational education areas, home economics, had changed dramatically from a curriculum for girls only to a family living approach concerned with consumerism, parenting, nutrition, human values and needs, and family relationships. The vocational education curriculum was changing to remove the sex stereotypes and to provide equal opportunity for boys and girls to participate in any part of the vocational curriculum that schools offered.

Soon after World War II, a close working relationship with the Department of Defense (DOD) began to develop. Vocational educators made use of some of the projects and programs developed by DOD and adapted these for the public schools. This was particularly true in the area of training programs such as engine overhaul.

By the end of the decade of the 60's, vocational education was the only discipline-related curriculum work remaining in USOE. Mandated by Congress to develop curriculum materials, the vocational educators dealt more directly with those who use the products of the system than did any others in the entire enterprise of education.

OTHER FEDERAL AGENCIES

A number of additional agencies of the Federal government dipped into curriculum development during the 1960's. Some only tentatively tested the water (National Bureau of Standards, National Institute of Health, Agricultural Research Service, for examples). Others stepped in further by producing curriculum supplements (National Aeronautics and Space Administration and the Atomic Energy Commission, for example). The Department of Defense continued curriculum development at the adult level and the Office of Child Development (OCD) began curriculum development on a modest scale at the pre-school level.

The National Aeronautics and Space Administration, NASA

The legislation that brought the Space Agency into existence was enacted in 1958. By 1960, James Webb, as director of NASA, had taken the position that education should be an important part of that agency's programs and an Education Programs Office was established with James Bernardo as Director. Bernardo had been active in the Civil Air Patrol and in the aviation education programs of the 1940's and 50's. He brought some of the same staff and flavor to the education programs of NASA.

In the early days, there was considerable discussion within the NASA staff and by science educators with NASA about their role in science education. Webb, as director of the agency, was participating in the interagency committee and interested in giving NASA a strong role in education. Activity in elementary science education as funded by NSF was just beginning. It was an appropriate time for NASA to enter into curriculum development if ever they were going to do so.

Educators who were interested in seeing NASA step into curriculum development pointed out that the space program encompassed all of the sciences. An integrated approach to science education could be developed by beginning in the elementary schools and continuing through the secondary schools, capitalizing on both the motivational and conceptual values of the new knowledge being generated in science and technology. At least one member of the education program staff, John Simms, was strongly urging that NASA become involved in curriculum development by working in cooperation with the National Science Teachers Association in a project aimed at the elementary school level. The majority of the staff preferred the more conservative stance of preparing supplements to the curriculum. The decision reached was that NASA would participate in producing materials and programs that would enhance the teaching of science in a supplementary way.[63]

NASA began production of a variety of publications. Some were of the "Sunday supplement" type designed to carry information to the lay public and, at the same time, have value for the schools. Others were, more specifically, the curriculum supplement type designed to serve as resource materials for the schools. Films and other audio-visuals were also produced. In addition, NASA developed the space mobile program patterned after an earlier program developed by the Atomic Energy Commission. The space mobiles were to carry the latest information on space to school assemblies and classrooms across the Nation. Lecturers were trained to give an hour-long assembly complete with exotic demonstrations to the entire student body and also to consult with the teachers with respect to the curriculum and ways in which more space science could be inserted. NASA also developed an effective working relationship with the science consultants in USOE in the early 60's.

Resource books were commissioned, written and published for chemistry, biology, space science, mathematics, and industrial arts. A publication for planetarium directors was also developed. Fact sheets were distributed regularly upon requests to schools throughout the nation. Other publications featured the Sky Lab experiments and the Earth Resources Technology Satellite photos. Resource materials on the Apollo moon landings and, more recently, the Viking and Pioneer programs, were developed for distribution to schools throughout the nation.

In addition to the NASA education budget, which ranged between $1,000,000 and $1,200,000 per year during the 1960's, funds were also brought into education from other program offices of NASA. The NASA centers, geographically distributed throughout the Nation, also assisted in the preparation of materials and programs of value to the schools.

NASA has not been involved in the curriculum controversies that have plagued NSF and USOE. Tuttle points out "that by maintaining a low profile in education, NASA may miss out on a few accolades but we also miss out on the brick bats and controversy. We are not a target. Our position is that we serve; we assist. That protects us. If you want our help, call on us. That's been our posture and I hope we can maintain it."[64]

As NASA points with pride to the wide range of curriculum supplements and the space mobile program, it also faces the same question that others face. Are the NASA materials being utilized in the schools? Is the space mobile lecture a show that entertains and is soon forgotten or does it have a real impact on the curriculum and on learning?

The Atomic Energy Commission (AEC)

Glenn Seaborg left his position as Chancellor of the University of California at Berkeley in 1961, after steering the CHEM Study program through its early years, to come to Washington as Director of the Atomic

Energy Commission. Partially due to Seaborg's interest in education, the Atomic Energy Commission initiated two types of programs during the sixties that were a supplement to the school curriculum. One was the mobile units that toured the United States offering assemblies on atomic energy, training courses for teachers, and equipping schools with Geiger counters and radioactive isotope kits so that innovative experimental work could be done in the schools.

The second type of program was the development and publication of a series of small monographs, curriculum supplements for either teacher or student use, entitled Understanding the Atom. This series, consisting of over 40 publications, was given free upon request to schools throughout the nation. Conveying knowledge about atomic energy, each booklet was devoted to a specific aspect of nuclear science and technology. Written in non-technical language, mathematical explanations are kept to a minimum for the intended audience, the senior high school student.

In addition to this series of booklets, the Atomic Energy Commission made available more than 100 educational motion pictures that could be borrowed without charge by schools from 10 film libraries located across the United States.

NBS, ARS, and NIH

In 1960, the National Science Teachers Association (NSTA) decided to develop a series of paperbacks that would feature up-to-date content

and new experiments in a variety of science areas. They invited the National Bureau of Standards (NBS), the Agricultural Research Service (ARS) of the Department of Agriculture, the National Institutes of Health and NASA to participate. Through the collaboration of agency personnel, scientists, educators, and classroom teachers, the Vistas of Science monographs were prepared for publication and distributed nationwide to schools through the Scholastic Publishing Company and McGraw-Hill Book Company

Department of Defense (DOD)

During the 1960's, DOD continued to develop instructional materials and to explore a wide range of teaching methods and mediums in its training programs for service men. Influenced by McNamara's systems approaches, specialists sought to systematize instruction. Management by objectives, programmed learning, and extensive use of educational technology became hallmarks of DOD curriculum development efforts.

As the servicemen's training curricula evolved, they served as useful models for the vocational educators in USOE who bore the responsibility for designing a vocational education curriculum for the Nation's schools. The DOD-supported overseas schools for dependents of service personnel had decisions to make regarding curricula. The NSF-funded curriculum projects were considered and often implemented as teachers from the over-

seas schools participated in the NSF summer institute programs.

Office of Child Development, OCD

In the early sixties, hopes for massive Federal aid to education had been badly damaged by brutal battles in Congress over the church-state issue and civil rights. But with the coming of President Lyndon Johnson to the Presidency, a substantial change seemed to take place. As part of his great society program, he was able to get the Equal Opportunity Act through Congress and signed into law in 1964.

In November of the same year, the first planning committee met and discussed the problems associated with launching a new program that called for a new pre-school curricula, entitled "Head Start." The program was officially announced in January of 1965 and Head Start was in operation on a nationwide basis by the summer of 1965 under the direction of the Office of Child Development of HEW.

Among Head Start's major comprehensive objectives were the following: (1) improving the child's health and physical abilities; (2) fostering the emotional and social development of the child by encouraging self-confidence, spontaneity, curiosity and self-discipline; (3) promoting the child's mental processes and skills with particular attention to conceptual and verbal skills; (4) establishing patterns and expectations for success in order for the child to create a climate of confidence for his future learning efforts; (5) increasing the child's capacity to relate positively

to family members and others while at the same time strengthening the family's ability to relate positively to the child; (6) developing in the child and his family a responsible attitude towards society, and fostering constructive opportunities for society to work together with the poor in solving their problems; (7) increasing the sense of dignity and self-worth within the child and his family. Although these objectives have continued to guide Head Start, the program has evolved considerably since its inception. Most early Head Start centers were varied, hastily-assembled adaptations of child-centered nursery schools long attended by middle class American children, which stressed social and emotional, not cognitive, development. Curricula for providing enrichment for children of the poor simply were not available in 1965. A few were being developed but they were in preliminary form. Since that time, there has been a proliferation of pre-school curricula models for disadvantaged children, based on different educational theories and methods.

During the late sixties, as it became evident that some of the new courses were too rigorous and sophisticated for the general school audience and that science enrollments were declining, there came a push for relevancy in the science program and for interdisciplinary or integrated flavor. In addition, the civil rights movement and a concern for children in the cities led to broadening courses in an attempt to reach

all, irrespective of races, sex, or socio-economic circumstances. Pressures began to be exerted to plan special programs for the gifted, for the slow learner, and for the handicapped child. Curriculum developers were encouraged to veer away from relatively "pure" disciplinary projects and to try to meet society's demands.

As the 1960's drew to a close, trends toward interdisciplinary courses and relevancy in education were apparent. The push for equal opportunity and special education were strong. Economics, politics, and social concerns were all having their impact on curriculum development.

DECADE OF THE SEVENTIES

Events don't become history until they have had time to settle into perspective and mellow a bit. It is difficult to write about the decade of the 70's in such close proximity to it. Perhaps, we can gain an overview of the first half.

As the decade of the seventies began, the Federal agencies involved in curriculum development were in trouble. The Creation Research Society was challenging the teaching of evolution in the schools and demanding that equal time be devoted to the teaching of special creation as presented in "Genesis" in the Bible. Certain members of Congress began to speak out against projects that confronted human values. Representative John Conlin of Arizona became the most vocal of the critics as he lashed out at NSF curriculum projects, most specifically, Man: A Course of Study (MACOS).

The National Science Board with funds getting short and inflation eating away at budgets began to protect the resources of NSF for scientific research. The NSF budget for education continued its dramatic decline. Policies imposed on the Education Directorate by the Nixon

administration's supervisors and OMB restricted funding to implementation of NSF projects. This approach was quickly challenged by educators and academicians who felt that the freedom of schools to choose any curriculum they wished and the freedom of higher education to offer any teacher training program they desired was being jeopardized. This implementation policy decision and guidelines for funding were altered to permit a slightly broader spectrum of projects to be supported but the aura of NSF as an agency relatively free of politics was on the wane.

Meanwhile, the U.S. Office of Education, unable to disseminate its products successfully and to operate assertively under its burgeoning bureaucracy, increasingly disenchanged Congress. In 1972, Congress created the National Institute of Education (NIE) to be the action agency for educational research and development.

As a result of NIE's poor start and lackluster record, Congress was in a mood to set a zero budget for NIE as 1975 drew near. Alarmed educators, Congressmen and government officers combined forces to bring about a reorganization of the National Institute of Education. John Corbally, President of the University of Illinois, was named chairman of an Advisory council and a strong group of educators agreed to serve with him. Harold Hodgkinson, professor of Education at the University of California at Berkeley, accepted the position of Director of NIE.

Meanwhile, other established agencies such as NASA, OCD, and DOD continued their role in education by supporting a modest but varied array

of curriculum development efforts. Newer agencies such as the Energy Research and Development Administration, ERDA (which subsumed the Atomic Energy Commission in 1973), the National Endowment for the Humanities, NEH, and National Endowment for the Arts, NEA, the Administration on Aging, AoA, and the National Oceanographic and Atmospheric Administration, NOAA, began to explore and, in some cases, to fund curriculum projects.

NSF in the Seventies

As the 1960's ended and the 1970's began, the National Science Foundation was surrounded by controversy. While the basis for some of it concerned peer review procedures and agency management, a large share was directed at the curriculum development programs of the Education Directorate. There were at least four facets of the curriculum development controversy: the teaching of evolution in the school, the nature of parts of the newer curricula such as MACOS and ISIS, the implementation policies of the Foundation, and the financial arrangements of some of the projects.

The teaching of evolution controversy was directed mainly against the Biological Science Curriculum Study, BSCS. When the BSCS biologists met to plan their curriculum work, they could not agree on a theme. As a consequence, they divided into three groups and developed three textbooks,

each emphasizing a different aspect of biology. The "blue version" had a molecular theme, the "yellow version" centered on cellular biology, and the "green version" stressed ecology, but all three carried a theme of evolution.

Fundamentalist groups in states such as Texas, Arizona, and California began to challenge the teaching of evolution in the schools. A new organization, the Creation Research Society, became established in California and opposed the teaching of evolution unless equal time were given to the concept of special creation as presented in The Bible. The California State Board of Education issued new guidelines for the biology curriculum in the state. These accepted the "Book of Genesis" as a reasonable explanation of the origin of life and required that the concept of special creation be taught as an alternative to the concept of evolution.

In 1972, the religion editor of the Washington Star newspaper sued the National Science Foundation for using public funds to support education that violated religious belief.[65] Certain Congressman such as John Conlin from Arizona and Robert Baumann of Maryland took up the cause for their constituency, by strongly challenging the curriculum development program. BSCS asked for help from science societies. Resolutions were passed in 1973 by organizations such as the National Science Teacher Association and the Commission on Science Education of the AAAS supporting the BSCS position on the teaching of evolution in the schools.

The BSCS biology program had become one of the largest and most vigorous programs funded by NSF. Their books were in use throughout the nation. Conservative and evangelistic groups charged that the new biology curriculum promoted the teaching of Godless behavior and encouraged atheism among the students. In a number of states, the requirement of equal time for the special creation concept became a part of state law or state guidelines, and the Creation Research Society, based in San Diego, California, began the development of modules to be used alternatively with the BSCS materials in the schools.

The MACOS Controversy

Jerome Bruner, a Harvard psychologist, and a group of social scientists and educators from the Educational Development Center (EDC) of Cambridge, Massachusetts, had developed under NSF funding an integrated social science course for 5th and 6th grade students that would explore three questions: What is human about human beings? How did they get that way? How can they become more so?[67, 68]

In order to develop these concepts, the designers of MACOS have students study the behavior of salmon, herring gulls, baboons, and finally people--the Netsilik Eskimos. Students explore questions about patterns of social interaction, the rearing of offspring, and the development of values and of a culture's view of the world. Animal behavior provides a

backdrop to the study of human behavior as children investigate how animals adapt to their environment and manage their own populations. By 1974, MACOS had found its way into 1700 schools in 47 states and was generally praised by the teachers who taught and the students who took it as a valuable and exciting program.[69]

The constituency that was disturbed by the teaching of evolution in the schools was even more disturbed by MACOS. These parents were concerned about values being taught in the schools, believing that values should be taught in the home or in the church. They were distressed that the schools appeared to be disseminating value systems as well as knowledge in the traditional sense.

The NSF became heavily engaged in fighting the fires of controversy as Congress increasingly questioned funding for curriculum development and Representative Conlin called for an end to Federal funding for curriculum development. Others called for censorship or Congressional approval. Representative Robert Baumann of Maryland proposed in 1975 that the bill authorizing the National Science Foundation to finance development of curriculum for public schools be amended to require Congressional approval for specific science curriculum projects.[70] The Baumann amendment was defeated, but the warning from Congress was clear. Funds for MACOS were terminated and further support of curriculum development projects was suspended pending a review of the entire National Science Foundation education program.

Three review groups were set up: One by the House Committee on Science and Technology, another by the General Accounting Office (GAO) and the third was initiated by the NSF itself.[71, 72, 73]

These reports made a number of recommendations. The House study recommended tightening the system for reviewing specific science education projects before they are implemented in public schools, adding laymen, parents, and community leaders to the review panels, a return to NSF's original stance of encouraging the schools to make their own choice of curricula free of any NSF "hard sell" revision of the peer review system of evaluating proposals and continued funding of MACOS with the provision that implementation should be a decision made by local institutions.

The GAO study made recommendations on the administration of pre-college curriculum projects to ensure sound business practices, the reporting and disposition of incomes such as royalties, and means of strengthening the management of NSF projects such as MACOS. The study also recommended that the Foundation Director (1) establish procedures for selecting peer reviewers of proposals for curriculum development to ensure that views of intended users such as school administrators and teachers are obtained and (2) review the need for establishing procedures to safeguard human subjects involved in educational activities.

The NSF report made a number of proeedural recommendations. Three important policy recommendations were also made to the National Science

Board by this group: (1) that the National Science Board develop a definitive policy statement that speaks to the purposes and objectives of curriculum development activity in the National Science Foundation; (2) that the National Science Board initiate a study to develop new mechanisms for administering grant or curriculum implementation activities that will allow the National Science Foundation to remain at arm's length from the process.

The three separate studies all made their recommendations in 1975 and generally supported continuation of the Curriculum Development movement, but with less emphasis on curriculum implementation and with more carefully defined guidelines and procedures. The recommendations of all three have been studied by Congress since that time. In June of 1975, the National Science Board met to make policy decisions on pluralism in education, curriculum development activities of the National Science Foundation and NSF implementation of science curricula. The Board generally affirmed the recommendations that had been made in these reports.

In 1976, Mr. Conlin continued his attempts to bring the MACOS issue into Congressional legislation. On May 11, 1976, during the House consideration of a bill to amend the Vocational Education Act of 1963, he offered the following amendment: "No grants, contracts or support are authorized under this or any other act for any educational program, curriculum research and development, administrator-teacher orientation,

or any projects involving one or more students or teacher-administrator involving any aspect of secular humanism unless there is also a fair and equal teaching of the world life view of Judaic-Christian principles set forth in the Old and New Testaments."[74] The amendment was defeated.

Why had MACOS ignited such emotional response? The controversy has been extensively documented.[75, 76, 77, 78, 79, 80] The major focus of the criticism seemed to relate to the materials on the culture of the Netsilik Eskimos and the behavior patterns of these Eskimos in order to survive.

One of the second generation projects, the Individualized Science Instruction System (ISIS), being developed at Florida State University for grades 10-12, has also come under fire. The project began with a conference held at Calloway Gardens in Georgia in October, 1971, under NSF funding. The Florida State University group that had earlier developed the Intermediate Science Curriculum Study (ISCS) brought together 34 chemists, physicists, biologists, physicians and economists to discuss the present state of the science curriculum and to make recommendations about new directions. The proposal for ISIS evolved and the project was funded initially by NSF in September, 1972. Within a year, it was apparent the project was not going to be able to carry out its original aim of 120 one-week modules. This seemed partly to be in recognition that a one-week module is too short and would lead to a choppy sequencing and partly that

it would be difficult to generate 120 topics for development. As a consequence, the original goals were cut back to 100 modules and more recently to 80 modules of 2-3 weeks duration. In the 1975-76 school year, 29 trial modules were made available to the schools.

Other questions raised about ISIS have to do with the management and expense of the project and the transmittal of reviewers' comments to the National Science Board. By December 5, 1974, more than $3,000,000 had been granted by the National Science Foundation to a project that was having difficulties executing its original plans. Reservations about the project were voiced by reviewers and seemed to center on five areas of concern: (1) Some reviewers felt that scientific concepts very often build on each other and were apprehensive that the nature of the proposed curriculum would inhibit such growth. (2) There were questions regarding the management system for schools and teachers . . . It was felt that the system neither sufficiently explained nor was the management plan begun early enough in the curriculum development stage. (3) Some reviewers felt that there was inadequate provision for laboratory and problem-solving situations within the learning scheme. (4) The evaluation procedures were attacked for being insufficient and too informal. (5) There was some speculation that the method of development might prove inefficient.[81]

The second ISIS proposal for support received only an in-house review. No external reviewers were invited to comment on it. With discontent

growing and Congress asking questions, NSF appointed a team of three outside reviewers in December of 1974 to conduct a substantive evaluation of the ISIS project. They also placed the ISIS project under close scrutiny and monitoring by the NSF staff.

The same groups and individuals who had opposed some of the themes of the BSCS biology and of MACOS also challenged three of the proposed ISIS modules. Three units in sex education: reproduction, birth and growth, and human sexuality came under attack.

Questions about curriculum innovation were on the increase. Should curriculum development become "big business" for organizations such as EDC and BSCS? How great were the problems that parents and teachers faced in struggling with new methods of teaching and new courses such as the "new math"? Should a federal agency such as NSF be "promoting" their funded projects through implementation programs? Why should commercial publishers be given preferred royalty discounts to publish the new materials? Should universities be funded, at taxpayers' expense, to train teachers for them? Why should value-laden programs such as "Exploring Human Nature" be allowed to continue development?[82]

In March of 1976, the National Science Foundation, sensitive to the controversy and to the Congressional concerns, announced that of the 19 active science curriculum development projects for elementary, junior high and senior high school, 8 of them would be considered complete, one

continued as originally scheduled, three would be continued, but reduced in scope and five would be discontinued. These decisions were based on budgetary considerations and on the results of reviews and evaluation by more than 70 outside experts, including scientists, educators, child development specialists and informed representatives of the public.[83]

For the eight projects considered essentially completed, only phaseout amounts of money have been added to their budget. Of the five projects so strongly challenged by the reviewers that they were to be discontinued, three have received phase-out funds and two others, Unified Science and Mathematics for Elementary Schools (USMES), and Exploring Human Nature, both under the direction of the Educational Development Center, have received substantial additional funds. The projects considered fundamentally sound but to be substantially reduced in scope included the Mathematics Resources Project, the ISIS project, and the Outdoor Biology Instructional Strategy (OBIS) project being developed at Lawrence Hall of Science at the University of California. Projects to be continued with funding as originally planned but subject to third party evaluation before dissemination were: the Human Sciences Project, an interdisciplinary behavioral, social and biological science project for grades 6-8; Comparing Political Experiences (CPE), a new political science curriculum for high school use; and the Bio-Medical Interdisciplinary Curriculum Project (BICP).

One new junior high level project was funded in 1976. Entitled "Crustal Evolution," this project is being developed by a consortium of

earth scientists located at Universities in Oklahoma, Maryland, Texas, Ohio State, Columbia and at Scripps in California. In early 1977, the NSF issued guidelines for proposals under their Development in Science Education (RISE) program.

Curriculum Development continues at the NSF midway in the 1970's, but at a reduced funding level and under more careful monitoring and third party evaluation. Dissemination plans are being required. The budget is small, but it may have hit its low ebb in 1975 and 1976.

Implementation Policy Controversy

From the beginning, an overriding principle in NSF was that while NSF would support research and development of substantive courses and the tools of instruction, Foundation funds were not to be used to promote the adoption of any specific curriculum, course or instructional materials.[84] These newly developed products were expected to compete on their own merits. Each teacher and each school must be free to decide if and how to use the materials developed.

In the early 70's, it became evident that the diffusion of the new curricula was not occurring spontaneously; that, in fact, the new programs were not being adopted by ehough schools to satisfy the original goals of the curriculum developers or of the Foundation in making funds available. The National Science Board and the Office of Management of the Budget began to seriously question the expenditure of Federal funds unless more effective dissemination and implementation could be demonstrated.

In 1969, the National Science Board had requested the Advisory Committee for Science Education to evaluate the effectiveness of the Foundation's program in science education including course content improvement and to make recommendations for the decade of the 70's. The Advisory Committee reported to the National Science Board and recommended the following: (1) increased emphasis on the understanding of science and technology by those who are not and do not expect to be professional scientists and technologists; (2) greatly increased support for the social and behavioral sciences with particular emphasis on the area of pre-college education; (3) first generation course content improvement programs still in progress should be supported to their conclusions; (4) second generation afforts should be focused on interdisciplinary, common-problem oriented approaches that provide for differences in student ability, background and vocational objectives.[85]

With substantial input from the Office of Management and Budget in 1973, there followed a re-examination and re-organization of the Foundation's science education programs. This led to increased emphasis on scientific literacy goals, relevancy and a trend to value-oriented social science and science curricula as the elementary and secondary school development program continued.

The National Science Foundation, which had long been concerned with the effective utilization of the curriculum materials developed with its

support, now began to emphasize implementation of these programs. Its policies and procedures concerning implementation assistance had evolved through a variety of teacher education programs, primarily summer, academic year, and in-service institutes. Now, NSF altered its budget to strongly encourage the Cooperative College School Science (CCSS) programs. These were directed toward implementation of a particular course and required a close working relationship between the teacher training institution and local school systems. Commitments from local school systems to seriously consider implementation of the program were now required.

The Office of Management and Budget (OMB) began to move more strongly into NSF educational affairs, particularly as the Nixon administration systems managers were placed in government agencies. A policy of OMB approval of proposal guidelines was initiated. Suggestions that NSF education programs might be moved from the Foundation and placed in USOE continued. Sixteen million dollars of the education funds were impounded by OMB in 1972[86] and a management by objectives system was instituted in 1973. External imposition of policy on the professional staff and the impounding of funds had a serious demoralizing effect.

Another psychological blow was struck when the Education Directorate of NSF was physically separated from the rest of NSF in 1973 and moved away from downtown Washington to a location on Wisconsin Avenue near

Chevy Chase. In 1976, Congress recommended that the Education Directorate be returned to the same location as the rest of the Foundation so that close liaison and cooperation between science and education could continue. To date, that recommendation has not been implemented.

Under prodding from the President's Science Advisor, Edward David, who wished to see NSF-funded projects such as the Engineering Concepts Curriculum Project (ECCC) find a place in the schools and pressure from OMB to demonstrate their success, the NSF staff moved strongly in the direction of implementation of NSF-funded programs. They released a set of guidelines which made only NSF-funded projects eligible for support.

This policy decision was unacceptable to many scientists and educators who had always valued the NSF tradition that full responsibility for selection of curricula for the schools rests with appropriate school agencies and that NSF was not in the business of promoting its own products. On the other hand, with their large investment in curriculum development, it beeame evident that the Foundation must accept some responsibility for assuring acceptance and use of the materials. Both Congress and OMB were pressing on this issue. As a result, the Foundation revamped and stepped up its implementation efforts and thus made a fundamental mistake in the judgement of many scientists and educators.

When NSF announced that NSF-supported projects only were eligible for implementation funds, a number of universities, in protest of this policy

and independent of one another, submitted proposals for funding of teacher training programs that were not based on the NSF programs. Three of these were based on the Interdisciplinary Approaches to Chemistry (IAC) course developed at the University of Maryland by a group of high school and college teachers who had worked together without Federal funding.

In 1973, the University of Maryland, Beaver College in Pennsylvania, the Illinois Institute of Technology in Chicago all placed IAC implementation proposals before the National Science Foundation for funding. This challenge caused a policy re-examination. Review panels gave all three IAC proposals high ratings and all three were funded. In 1974, the NSF changed its policy guidelines to read that implementation funds were available for the support of NSF-funded projects or an equivalent program in national use. This was a fortunate modification of policy on the part of NSF for when Congress began to challenge the propriety of NSF's effort to promote its own products, the Foundation was able to point to the fact that they had provided implementation for IAC which was not one of their own.

Now there seemed to be at least three policy-making groups. The NSF staff, itself, on the firing line and close to the scientists and educators in the school systems and universities, was one. Another was the National Science Board which considered proposals presented to them by the Education Directorate and approved, disapproved and altered policy.

The third and new entry in the policy-making role began to take on increased potency as personnel was appointed from the President's office and from OMB. There were systems analysts who believed in management by objectives. Often they were without science or education background, but they began to dictate science education policy.[87, 88] The excitement and creativity of curriculum development was effectively dampened as the NSF staff found itself increasingly caught up in controversy.

Financial Controversy Arises

By the middle of the 1970's, John Conlin was charging that the developers of projects such as PSSC, IPS, ESS, and MACOS, the Educational Development Corporation (EDC) had become "big business." "Make no mistake about it. Curriculum 'innovation' is Big Business for EDC. This multi-million dollar operation, which gets more than 87% of its funds from U.S. and foreign government agencies, is involved in a worldwide effort to push its particular brand of education. EDC receives almost 33% of its funds from NSF, which has pumped more than $33.6 million its way since 1963."[89]

The BSCS group in Boulder, Colorado had become embroiled in a financial dispute with NSF and the Government Accounting Office. The Foundation, in 1974, claimed that BSCS owed $1.2 million to the government. BSCS challenged this claim and insisted it had acted properly and

with NSF approval in the disposition of royalties. GAO and Congress became interested in the affair and by March of 1976, the Science and Technology Committee of the House had directed NSF to cut off funding to BSCS until the claim was satisfactorily settled. This placed work on the new Human Sciences Program (HSP) for the middle schools in question.

After three months of negotiation and the establishment of an escrow account to cover the claim, if found valid, funding and work on HSP was allowed to continue. The problem is complex, is likely to require a great deal of time and energy from all parties to reach resolution and may, in fact, end in litigation.[90]

In the early days of curriculum development, it had not been possible for either developer or NSF to forecast the problems that would arise out of royalty arrangements, residual business expenses and other financial arrangements. Now some of the early decisions came back to haunt grantor and grantee alike. The magnitude of curriculum development programs such as those of the BSCS had grown far beyond the scope originally visualized.

Administrative and Legislative Decisions

In setting policy and approving selected proposals over the years, the National Science Board has evidenced both interest and uncertainty about NSF's Curriculum Development program. This has led to a number of reviews and task forces charged with studying the involvement of NSF

in this type of activity. During the controversies of the 70's, the National Science Board seems to have focused most of its attention on protecting scientific research. One cause of this may be the lack of familiarity with science education. The National Science Board has never had on it a science educator with a strong K-12 background.

Recent administrators of the Foundation have not always been supportive of education. Funds have not been expended, proposed budgets have been small and education has been give a lower priority.[91]

At times, the Congress has seemed more friendly toward science education than the management of NSF. It is Congress that increased the amounts of money proposed for education by NSF management and in the President's budget to maintain a reasonable level of science education programs and to keep the course improvement projects going.

Two Congressional Committees, the Teague Committee in the House and the Kennedy Committee in the Senate, have spent long hours looking into NSF funding for science education and generally have been supportive of curriculum development efforts.

In 1972, committees of Congress had begun to seriously challenge the NSF policy that the summer institutes aimed at upgrading the science subject-matter proficiency of teachers should be phased out and implementation programs of the COSS type be stressed. In fact, so many questions were raised about these policies that by 1975 there was no funding available from Congress for teacher training programs of any type. Implementation activities had been cut to zero.

In 1976, Congress helped to regenerate a teacher training budget by appropriating slightly over $4,000,000 to reestablish pre-college teacher training programs that would be primarily disciplinary in nature and operate either in the summer or during the academic year in a mode similar to the earlier in-service institutes.

Crane carefully documents the evolution in NSF from teacher institutes independent of curriculum projects to teacher training programs based heavily on curriculum implementation; from an agency operating relatively independently to one now heavily influenced by Congress and the Executive through OMB; from one that encouraged a creative, connoisseurship approach to innovation to one managed by objectives; from one where education was a high priority in the days of Alan Waterman to one where Director Gayford Stever termed education a "lesser priority"; from a concern for upgrading and updating the curriculum in science and mathematics to a swing to the social sciences and the controversy it engendered; from Congressional support without interference to Congressional support with strings tied and monitoring.[92]

Curriculum development at NSF is expected to continue at a modest level. In 1976, the acting director, Richard C. Atkinson, stated, "We've been hobbled with the issues of Individualized Science Instruction System (ISIS) and Man: A Course of Study (MACOS) and so forth." He expressed his hope that now the Foundation could move on with greater productivity.[93]

Members of the education staff, whose time, effort and emotions have been largely consumed in controversy for the past 4 or 5 years, also look forward to the opportunity to move on constructively.

In the mid-70's the role of NSF as the primary curriculum development agency of the government is still being questioned. The curriculum development roles of USOE and NIE and other government agencies seem to be gathering strength, thus spreading curriculum development responsibility more broadly throughout the Federal Government.

USOE in the 70's

Early in the 1970's, USOE continued to struggle with its identity as an agency with responsibility for curriculum development. The Vocational Education programs administered under USOE were becoming more involved in curriculum development as a result of the 1963 and 1968 legislative acts. Title IX of ESEA which drew little attention earlier now began to gain prominence. This title required equal opportunity without prejudice with respect to sex. As the vocational educators attempted to cope with providing equal opportunity for boys and girls in the home economics, agriculture, and industrial arts curriculum, it became apparent the sex stereotyping was common in other areas such as physical education and science.

Curriculum reform was essential. The newest legislation in vocational education, passed in 1976, calls for reorientation of the vocational education curriculum to eliminate sex bias and to be more efficient and productive in establishing terminal skills for students who do not plan to go into higher education.

In 1974, USOE handed off its ERIC centers and its Regional Centers and Laboratories to the new agency NIE created to take the lead in educational research and development. But it still had the problem of how to cope with dissemination of materials to state and local groups. Exemplary materials developed under ESEA funding had been identified and a series of "It Works" booklets was published by the Bureau of Elementary and Secondary Education to be disseminated to state departments of education and local education agencies to assist them in their curriculum development efforts.[94] However, these booklets have not effectively reached their audience. One of the problems associated with their dissemination seemed to be that there was no carefully planned and well-organized dissemination plan, the same old problem of OE-funded curriculum development efforts.

In 1973, USOE entered into a contract with Research Management Corporation (RMC) that required this organization to study the feasibility of packaging exemplary projects in compensatory education in sufficient depth and detail so that the packages themselves could constitute a viable

means of replicating successful practices. These packages came to be known as Project Information Packages (PIP).[95] They contained manuals and other materials explaining the role and responsibility of all major project participants. The descriptions were detailed enough to enable adopting school systems to carry out all aspects of planning, initiating and operating the project. They are directed primarily to elementary school reading and mathematics. In making PIPS available, the U.S. Office of Education was attempting to fulfill its role of offering technical assistance to the school systems in the area of curriculum development. It is being very cautious not to assume the role of advocate for any set of curriculum materials. Dissemination is still poor, but the packaging of exemplary projects for export from the developers to other systems seems to be gaining some success.[96]

Curriculum development for educational television is another area that has received USOE funding. Some educators believe that the curriculum outside the school may be more influential today than the curriculum within school walls. It is estimated that children of elementary and secondary school age spend more hours watching television than they do in the classroom.

It seemed important to develop programming for television that would not only entertain youth but provide them with good learning experiences as well. One example of this type of curriculum development is the work of the Children's Television Workshop of New York City, the producers of

Sesame Street and The Electric Company. The Office of Education has been one of the funding agencies for this series and announced the awarding of $5.4 million to Children's Television Workshop for 1976 to enable this group to carry out activities designed to increase the impact of both shows and to build up and maintain the audiences.

In addition to this large grant for Sesame Street and the Electric Company, the Office of Education in 1976 announced four more grants to educational television in recognition of the informal curriculum outside the schools. One is for 20 half-hour television shows and accompanying activity guides to help new and prospective parents become more effective as "first teachers" of their children. The contract is to Applied Management Sciences of Silver Spring, Maryland with the Institute for Child Study at the University of Maryland serving as the consulting group of educators. Another grant has been given to Allied Chemical Corporation to produce ten half-hour television programs entitled "Music Is" for students in grades 4-6. This is being produced in conjunction with the National Symphony Orchestra and each program will focus on a different music element such as style, rhythm, harmony, and form.

A grant was made to Smithsonian Institution in Washington to produce a single film entitled "Black Presence in the American Revolution" for use in schools, prisons, literacy programs and community centers. Another grant went to Abt Associates in Cambridge, Massachusetts, to complete

publication of curriculum materials and teachers' guides for two alcohol education film series, "Jackson Junior High" for students in grades 5-8 and "Dial ALCOHOL" aimed at high school students. These projects, all five of them, were supported through discretionary funds.

In 1974 and 1975 the following change agent programs: Elementary and Secondary Education Act, Title III, Innovative Projects; Elementary and Secondary Education Act, Title VII, Bilingual Projects; Vocational Education Act of 1968, Part D, Exemplary Programs; and the Right to Read program were reported by Rand Corporation.[97] In each of these cases, USOE had dispersed "seed money" to school districts to encourage innovative practices in public schools. This four-volume study that attempts to assess the impact of these educational change programs comes to the conclusion that a receptive institutional setting is a necessary but not sufficient condition for effective implementation and implementation strategy that promotes mutual adaptation is critical.

The main factors affecting innovation were the institutional setting, particular organizational climate and motivation of participants, the implementation strategy employed by local innovators to install their project treatment, and the scope of the change implied by project relative to its setting. Neither the technology nor the project resources nor the different Federal management strategies influenced outcomes in major ways. Thus, project outcomes did not depend primarily on inputs from outside, but on internal factors and local decisions.[98]

This conclusion has powerful implications for curriculum development from the Federal perspective. There is a great need to understand better the motivations and reward systems which operate in a local school system. It is not readily apparent that working hard on curriculum development or fostering curriculum innovation is something which is rewarded necessarily by local school systems. What will be rewarded in local systems is finding and identifying a need which the local community has expressed or the local education group has expressed and then finding a way, an innovative way, hopefully, to meet that need through some new or modified curriculum development work.

THE NATIONAL INSTITUTE OF EDUCATION

As the 1960's wound to a close, it became increasingly evident to the Johnson administration and to the Congress that USOE had become so heavily involved in dispersing funds to state and local units that it could not function as an active national research and development center. A task force group was brought together to consider the problems and to make recommendations to the administration. McMurrin reports that, as a result of the work of this group, a recommendation was made that the National Institutes* of Education be created and placed in HEW, independent of the Office of Education, with the Head reporting directly to the Secretary or Under-secretary of HEW.[99]

The proposed Institutes of Education would be patterned after the National Institutes of Health. Each would have specific responsibilities. The first was proposed to be an institute on educational technology with others for curriculum development and research to follow. What the task force had in mind was a new unit that would deal with all substantive

*Note the plural.

matters in education, including research, so that USOE could continue in the direction in which it was so rapidly going, the distribution of federal monies on a formula basis and collection of educational statistics.

The original conceptualizers of NIE also proposed a large budget, of the order of $550 million for the first year, so that this new agency could move strongly into action programs of research and development.[100] When NIE was created, it became the National Institute of Education* with a small budget of the order of $70 million.

NIE got off to a slow and rocky start in 1972. Instead of recruiting educators with fresh ideas from the field to head the agency, bureaucrats were moved within the government. NIE, within its first two years of operation, lost so much ground with Congress that it was on the verge of dying with only a two-year lifeline.

In 1974, in an attempt to salvage this agency, a new director, Harold Hodgkinson from the University of California at Berkeley, was recruited from the field, and new staff were brought in to give it a more active stance. The work of NIE in the next two years, 1974 to 1976, was sufficiently positive and active that it began to appear that NIE might become a permanent agency able to provide a measure of leadership in research and development.

The Regional Laboratories and R&D Centers had been moved from USOE to NIE in 1972. Some were very weak and none were reaching the

*Singular

schools of the nation effectively with their products. In March of 1975, NIE assembled a panel of 10 consultants to review the Laboratories and R&D Centers. The group was chaired by Roald Campbell of the University of Chicago. Their report issued in August had a number of recommendations to make.[101]

The Campbell report suggested, for example, that there could be a smaller set of national educational R&D Centers with more diverse ties to universities. They called for long-range planning in place of a piecemeal approach and for strengthening and preserving a smaller number of these units that have significant potential. The report also recommended that no more than one third of NIE's program funds should be allocated to these R&D Centers.

With respect to curriculum development, the Campbell panel recommended that the NIE devote explicit and public attention to issues of the value of curriculum development as a strategy for aiding schools.[102]

Weaker regional laboratories and centers were phased out and the strong ones were encouraged to proceed with their research and development work. By April of 1975, the twenty regional educational laboratories had been reduced to seven, the nine R&D centers were still operating. It is interesting to note that the R&D Centers, which were attached to universities, have not suffered the same fate as the laboratories which

were more independent. Perhaps this says something about the need for a close connection to an institution that is primarily concerned with the discovery and dissemination of knowledge through research.

Following attention to the quality of the R&D Centers and Laboratories, the NIE was instructed in September, 1975 by the National Council on Education Research (NCER) to move into the area of curriculum in the following way: "The Council requests the Director to arrange, if possible in conjunction with others, such as the National Science Foundation and the Chief State School Officers, for the preparation of contending, informed "briefs" on the value of curriculum change as an aid to schools, for systematic public discussion of the briefs and for the preparation of recommendations to the Federal Government on future funding policy in this area."[103]

In November of 1975, an NIE Curriculum Development Task Force was appointed to begin carrying out the activity of the resolution. Jon Schaffarzick from Stanford University was brought into the NIE staff to head the task force, and a limited staff went immediately to work. By January of 1976, they had released a first report that contained observations, conclusions and recommendations based on interviews that task force members had conducted with representatives of over 60 organizations and a study of at least 50 documents relating to Curriculum Development. As a result of their work, they drew the following conclusions: (1) The

overriding interest on the part of a wide array of individuals and groups is to have a piece of the action at all levels of curriculum decision-making. (2) This concern for involvement is accompanied by a feeling of impotence, of not being heard and of having only a limited scope of influence. (3) Most of the views contain assumptions about where decisions are made, who is or isn't listened to, and what now exists in school programs and must be changed. (4) Although approaches to resolving dilemmas in curriculum improvement did not come through in the interviews, the designated arena for resolution is local. (5) There is widespread dissatisfaction with the failure of past strategies of curriculum development and change to enlist the collaboration of interested groups.[104]

The task force concluded that it is inconceivable that NIE could fulfill its mission for improving the quality of American education without directing some resources to curriculum development and change. They then recommended a number of activities for the agency. (1) That NIE should provide a number of forums for discussion of current curriculum issues under conditions that would facilitate and encourage a more genuine debate than has heretofore taken place and in which there would be a presentation of the full range of views and maximum attention paid to relevant research and scholarship. (2) NIE should study the manner in which curriculum development and change takes place in the U.S., with an eye to improving the process. (3) The NIE should undertake a study

of the feasibility of a general survey of programs actually offered to students in a carefully selected sample of schools across the country and of actual efforts under way to change these programs. (4) The NIE should undertake a study of the successes and failures of major efforts at curriculum reform in the U.S. and abroad in the last two decades.[105]

The report of the task force was made available for discussion at the American Educational Research Association (AERA) meeting in San Francisco in the Spring of 1976. Following that meeting the Task Force commissioned the preparation of a series of discussion guides, scholarly papers, analytical papers and "How I Did It" papers to be prepared by successful curriculum developers. All of these papers were to be produced and brought together as the grist for the mill of a national conference scheduled in Washington, D.C. in November, 1976. NIE was moving aggressively in the area of defining Federal role and Federal involvement in curriculum development by the middle of the decade of the seventies. They were well along with successfully implementing their own recommendations. NIE was now assuming some measure of leadership in curriculum work.

OTHER FEDERAL AGENCIES

The NASA Space Mobile program continues, as does the publication of curriculum supplements. The most recent set of four monographs carry the statement on their title page.

During the 70's, NASA has continued its "low profile" approach to education and continues its work as curriculum supplementers rather than curriculum developers.

In 1972, the Atomic Energy Commission was phased out and the Energy Research and Development Administration (ERDA) took its place with a broader mission that ranges beyond atomic and nuclear energy into all possible sources of energy production and use. ERDA established an education office which indicated an interest in going beyond curriculum supplements into curriculum development projects. The first tentative steps have been in the direction of developing resource books and fact sheets. In 1976, the development of teaching units on energy for use in the science, mathematics, social sciences or English classes began. This development work has been done by the National Science Teachers Association (NSTA) under funding from ERDA.

Agencies such as the Administration on Aging (AoA), the National Oceanographic and Atmospheric Administration (NOAA), the Arts and Humanities Endowments are inviting modest proposals for curriculum development.

RECAPITULATION

This study of three decades of curriculum development has emitted a collection of data -- dates, personnel, products, fundings -- that appears as appendix material. While it doesn't fit into the narrative, it should be retained as part of the history and is compiled at the end of this paper.

This final section is an attempt to briefly summarize some of the ideas and trends that evolve from the history.

Changes Over Time

The pendulum swings from one extreme to the other over time, with every variation in between being part of the system. For example, one can trace the waxing and waning of academicians' interests and efforts in curriculum development. The shifts from permissive education in the 50's, to rigorous academics in the 60's, to relevancy in the early 70's and "back to basics" in the mid-70's represents a double cycle. In the 1950's, there was little money available for curriculum development, a generous supply in the 1960's and a return to austerity in the 1970's.

The undershooting and overshooting of the intellectual and maturity levels is another change path that can be followed. In the 1950's, the science courses, as an example, were considered to be too "easy" -- not challenging enough. In the 1960's, as the new curriculum were implemented, it became apparent that many were too sophisticated, too "hard" for the majority of students. Attempts have been made to bring the reading level and level of abstraction down. Now the concern is that the rigor is gone. The question of how to meet the learning needs of a very massive and diverse student body in the Nation's schools continues to plague the curriculum developer.

Changes in social goals also dictate changes over time in curriculum focus. In the 1950's, as scientists, educators and the public wondered if our scientific and technological competence was competitive with USSR's, the push was for updating and upgrading the curriculum in the direction of academic excellence. In the 1960's, the social climate shifted and the curriculum concerns became those of relevancy and equal opportunity. In the 1970's, with the economy staggering, the curriculum is being forced in the direction of basic education, vocational education and the development of the skills necessary for survival in the world of work.

Forces That Have Shaped Curriculum Development

There are so many voices that speak for what is "right" and what is "possible" in curriculum development that it is one of the most difficult tasks of the designer to listen, learn, and reach a reasonable balance.

The curriculum is shaped, in part, by the money available. Economics dictate curriculum. Decisions such as how often instructional materials will be revised, whether new materials can be designed, the extent of laboratory activity in science programs, the production and use of audio-visuals are all finance-based decisions.

Good curriculum development work takes time, and time has sometimes been more scarce as a commodity than money. Creative curriculum work cannot be done as an adjunct to a full day of teaching or of administration, as local groups have so frequently learned through experience. Blocks of undisturbed time must be set aside for personnel engaged in curriculum development if the creative processes of planning, designing, developing, testing, revising, and implementing are to be completed successfully. Experience indicates that there must also be time for evaluation, for teacher training and for parent orientation and involvement, if a curriculum change is to "take."

Space in the curriculum is another force. In order for new courses or new units to move into the school curriculum, existing courses must be condensed, scrapped or modified to make room. Inertia and vested interests

both mitigate against change. A majority of teachers, parents and administrators feel comfortable with the familiar and resist change.

Side effects can't always be predicted. New programs usually mean additional funds and time and effort on the part of school personnel to implement them successfully. Parents, too, exhibit insecurity, as their offspring bring home assignments in the "new math" or "new science." An expanding or novel curriculum places undue stress on everyone in the system: the administrators, the parents, the teachers and the students as they try to cope with the unfamiliar and to adjust the existing curriculum to accommodate the new.

Each segment of the community concerned with education exhibits individual and group interests that help shape the curriculum. The opinions, ideas, and pressures from academicians, educators and a concerned citizenry all compete for attention. The successful development of a new curriculum has often been dependent on the leadership of a committed individual, someone with the charisma to bring creative people together in productive work.

Another strong force in determining curriculum change and design comes from commercial interests in education. The textbook publishers, the film makers, the equipment manufacturers all believe that they "know" what is best for the schools and what changes the market will bear. Since commercial publishers will invest money only in products that are attractive

to them as money makers and since curriculum dissemination has been unsuccessful without them, commercial publishers, to a very high degree, control the rate of change in curriculum.

On the local scene, textbook selection committees and curriculum development committees are endlessly at work making curriculum decisions for their system or school. The colleges and universities in the local area exert another force as they design and conduct their programs for the pre-service and in-service training of teachers and other school personnel. As school administrators make decisions that lead to open schools or vocational schools or comprehensive schools, curriculum is being carved to fit the grand designs.

A vocal minority can have a profound impact on local curriculum decisions as has been witnessed time and time again. By opposing the teaching of material they consider controversial, articulate spokesmen representing liberal or conservative or reactionary or evangelistic constituencies are a powerful force in curriculum decision-making.

Governmental actions clearly help to shape the curriculum. This has been more apparent at the Federal than State level. The impact of decisions made on policy or on funding by the Federal agencies, by the Congress, by the Courts, and by the administrative advisors and offices of the government has been a running theme throughout this paper.

The force of political, economic and social change in the culture

is a powerful wind that frequently determines what can and what cannot be accomplished. We are just now learning to evaluate and predict some of the unwanted side effects of curriculum change.

With the time, money, and logistics constraints that operate, how can everyone who has a stake in the outcomes of curriculum development have a say in the decision-making? That is a major question that faces the curriculum developer midway through the decade of the 1970's. History indicates a need for meaningful involvement of teachers, publishers, and parents in the early stages of curriculum development, but how can this be accomplished? The history provides clues but the answers are far from clear.

The paper has only begun the telling of a wondrous tale. Hopefully, it will stimulate scholars to seek out the detail (document it thoroughly) and trace out this history in its entirety.

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Appendix A

Dates

Personnel

Projects

U.S. Commissioners of Education

Henry Barnard	1867-1870
John Eaton	1870-1886
N.H.R. Dowson	1886-1889
William Torrey Harris	1889-1906
Elmer Brown	1906-1911
Philander Claxton	1911-1921
John Tigert	1921-1928
William Cooper	1928-1933
George Zook	1933-1934
John Studebaker	1934-1948
Earl McGrath	1949-1953
Lee Thurston	1953-1953
Samuel Brownell	1953-1956
Lawrence Derthick	1956-1961
Sterling McMurrin	1961-1962
Francis Keppel	1962-1966
Harold Howe	1966-1968
James Allen	1969-1970
Sidney Marland	1970-1972
John Ottina	1973-1974
Terrel Bell	1974-1976

Important Dates

1862	Morrill Land Grant College Act
1892	Elliott Committee*
1912	Children's Bureau created in Department of Commerce and Labor
1917	Smith-Hughes Act
1918	Cardinal Principles*
1929	George-Reed Act (Vocational)
1934	George-Ellzey Act (Vocational)
1936	George-Deen Act (Vocational)
1946	George-Barden Act (Vocational)
1950	The National Science Foundation is established
1953	Children's Bureau moved to DHEW
1954	Cooperative Research Act established Federal role in Educational Research & Development
1957	NSF begins Educational Research & Development work with funding of PSSC, first secondary science project
1958	National Defense Education Act (NDEA); modern language program funded
1958	First mathematics program (SMSG) funded
1960	AEC initiates mobile units
1960	NASA Education Office established
1960	First elementary science projects (ESS and SAPA) funded
1961	USOE begins curriculum improvement projects in English, language arts and social sciences

*Non-governmental projects influenced by participation of the USOE Commissioner.

1961	NASA, NBS, NIH, USDA participate in NSTA Vista of Science series of curriculum supplements
1961	AEC begins publication of the "Understanding the Atom" and "World of the Atom" series
1963	Vocational Education Act
1963	NASA begins Space Mobile Program and preparation of curriculum supplements
1963	National Centers for Educational Research & Development (NCERD) created
1964	Children's Bureau initiates Project Head Start
1965	Elementary and Secondary Education Act (ESEA)
1968	Vocational Education Amendments to 1963 Law
1969	Office of Child Development (OCD) created
1967	Project Follow-Through initiated in USOE
1972	The National Institute of Education created
1972	NCERD's transferred to NIE
1974	Experimental projects in USOE; discretionary funding
1975	MACOS Controversy
1976	Vocational Education Amendment to 1963 Law
1976	NSF continues Curriculum Development on modest scale; funds new Crustal Evolution project
1976	Energy Research & Development Administration (ERDA) begins funding curriculum units

Directors of NSF

(started in 1951)

1951-1963	Dr. Alan T. Waterman
1963-1969	Dr. Leland J. Haworth
1969-1972	Dr. William D. McElroy
(Acting-Jan.1972)	Dr. Raymond L. Bisplinghoff
Feb.1972-Aug.1976	Dr. H. Guyford Stever
(Acting-Sept. 1976 to present)	Dr. Richard C. Atkinson

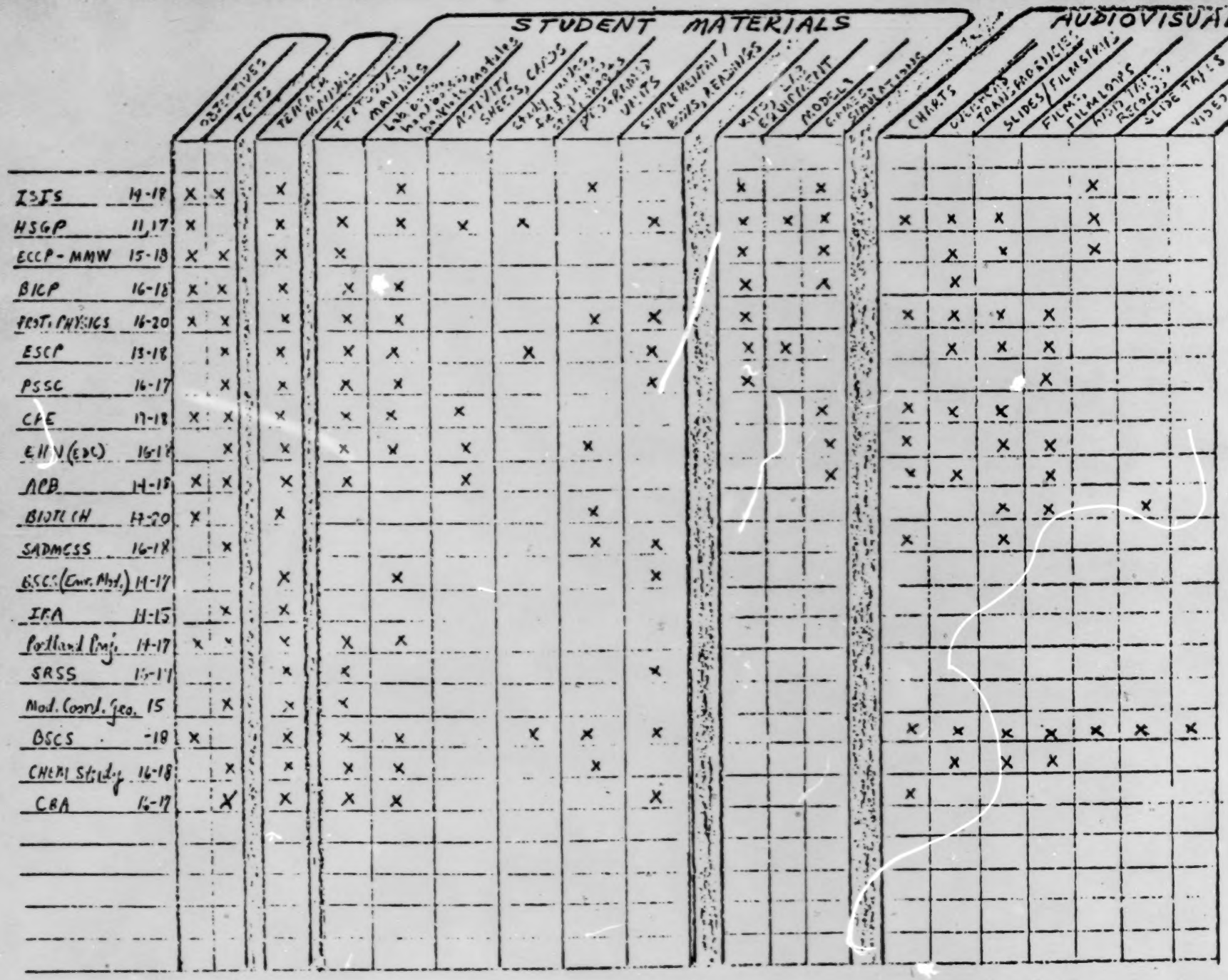
Associate Director for Education

Jan.1965-June 1966	Dr. Henry W. Riecker
1966-1969	Dr. Thomas D. Fountaine

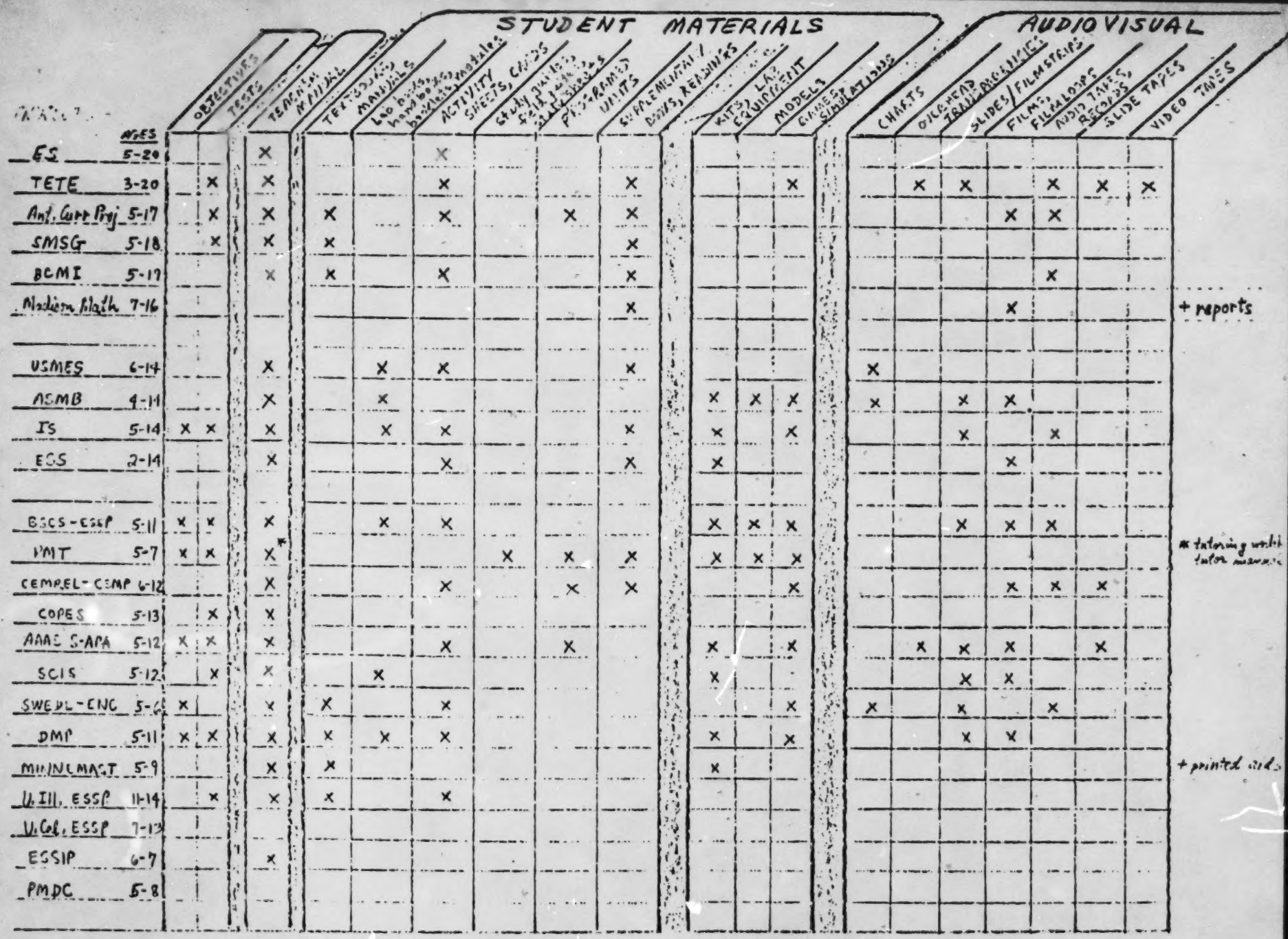
(Reorganzation took place - title became:)

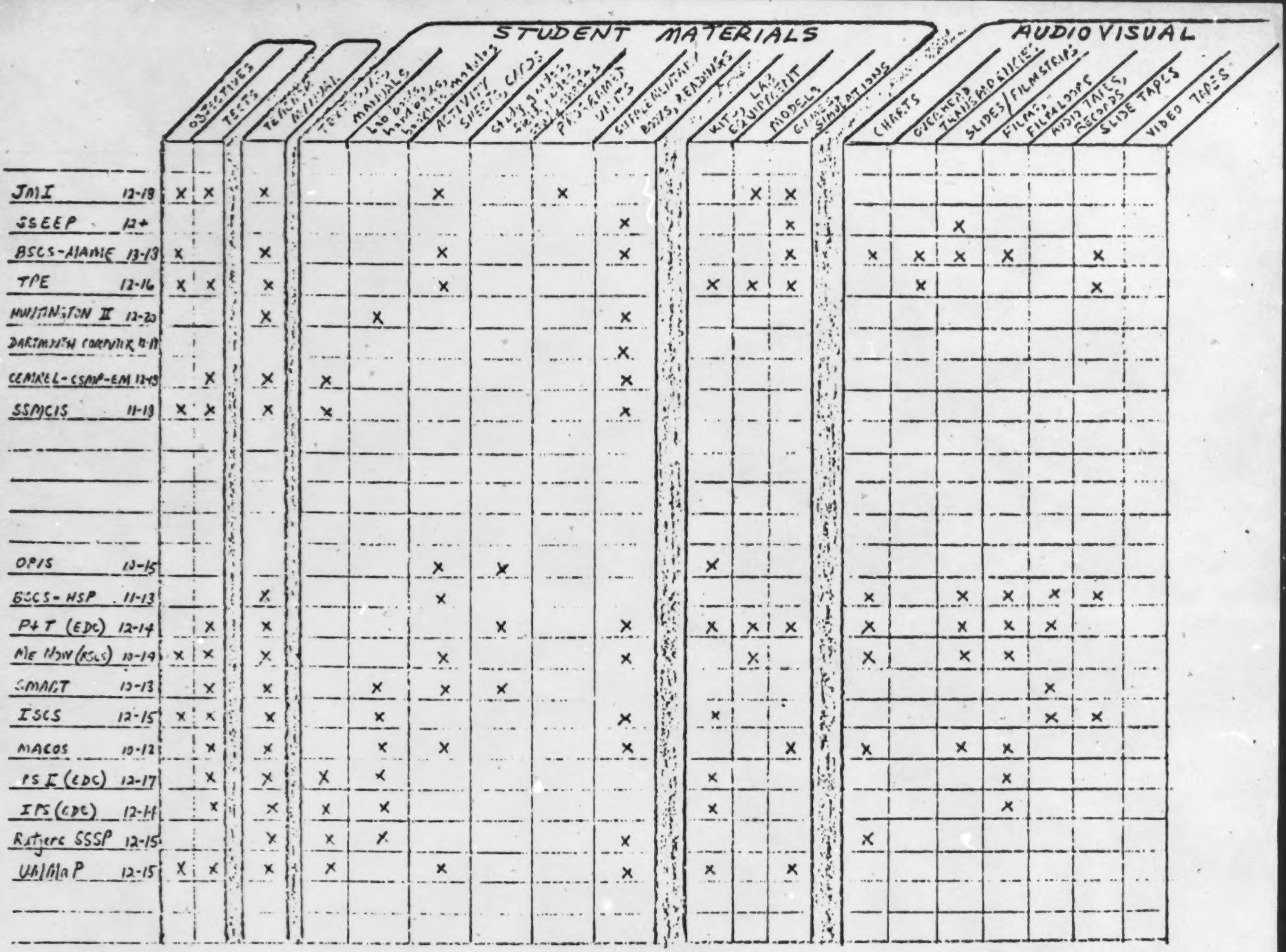
Assistant Director for Education

Vacant Oct. 1969 - June 1970	
1970-1971	Dr. Lloyd G. Humphreys
(Acting 1971-1973)	Dr. Keith R. Kelson
1973-1975	Dr. Lowell J. Paige
1975-present	Dr. Harvey A. Averch



Compiled by Joseph Dasbach from Science and Mathematics Curriculum Developments Internationally 1956-1974. J. D. Lockard, editor. University of Maryland. 1975.


STUDENT MATERIALS
AUDIO VISUAL
OBJECTIVES
TESTS
TEACHER MANUAL
TEXTBOOKS
MANUALS
Lab books, handbooks, booklets, modules
ACTIVITY SHEETS, CARDS
Study guides, Self-paced lessons
PROGRAMED UNITS
SUPPLEMENTAL BOOKS, READINGS
KITS, LAB EQUIPMENT
MODELS
GAMES, SIMULATIONS
CHARTS
O/H/OVERHEAD TRANSPARENCIES
SLIDES/FILMSTRIPS
FILMS, FILMLOOPS
AUDIO TAPES, RECORDS
SLIDE TAPES
VIDEO TAPES
AGES
ES 5-20
TETE 3-20
Anl. Curr. Proj 5-17
SMSG 5-18
BCMI 5-17
Modern Math 7-16
USMES 6-14
ASMB 4-14
IS 5-14
ECS 2-14
BSCS-ESSP 5-11
PMT 5-7
CEMREL-CEMP 6-12
COPES 5-13
AAAS S-APA 5-12
SCIS 5-12
SWRL-ENG 5-6
DMP 5-11
MINNEMAST 5-9
U. Ill. ESSP 11-14
U. Col. ESSP 7-13
ESSIP 6-7
PMDC 5-8
+ reports
* tutoring with tutor manual
+ printed aids


STUDENT MATERIALS
AUDIO VISUAL
OBJECTIVES
TESTS
TEACHER'S MANUAL
TEXTBOOKS
LAB BOOKS, HANDBOOKS, BOOKLETS, MODULES
ACTIVITY SHEETS, CARDS
STUDY GUIDES, WORKBOOKS, PROGRAMMED UNITS
SUPPLEMENTARY BOOKS, READINGS
KITS, LAB EQUIPMENT
MODELS, GAMES
SIMULATIONS
CHARTS
OVERHEAD TRANSPARENCIES
SLIDES / FILMSTRIPS
FILMS, FILMLOOPS
AUDIO TAPES, RECORDS
SLIDE TAPES
VIDEO TAPES
JMI 12-18
SSEEP 12+
BSCS-MIAMI 13-13
TPE 12-16
HUNTINGTON II 12-20
DARTMOUTH COMPUTER 11-17
CEMREL-CSMP-EM 13-15
SSMCIS 11-18
OPIS 10-15
BSCS-HSP 11-13
P+T (EDC) 12-14
ME NOW (BSCS) 10-14
SMART 12-13
ISCS 12-15
MACOS 10-12
PS I (EDC) 12-17
IPS (EDC) 12-14
Rutgers SSSP 12-15
UMMaP 12-15

II. Findings, Observations, and Policy Issues

This section contains a general survey of curriculum projects and synopses of five case studies chosen for detailed analysis by the review team. Also presented are observations that represent a consensus of the review team. Policy issues that were identified during the study are organized to reflect the flow of activities in curriculum development projects and were discussed jointly by the members of the review team and the Science Education Advisory Committee in meetings held May 9 and 10, 1975.

Director Stever charged the review team and Committee with ensuring that:

- the proposed subject matter fits within reasonable limits or norms with respect to educational value
- the scientific concept is accurate
- the course developers are responsible and competent persons
- the institutional and contractual arrangements are sound.

The list of 53 curriculum projects follows. More than half were reviewed in some depth by the team. Detailed case study summaries from which the synopses were drawn are to be found in Volume II, Appendix 4.

LIST OF CURRICULUM PROJECTS

	Curriculum Project	*Current Status*
**1.	Physical Science Study Committee (PSSC)	Completed
**2.	School Mathematics Study Group (SMSG)	Completed
3.	Chemical Bond Approach (CBA)	Completed
**4.	BSCS Biology	Completed
*5.	CHEM Study	Completed
6.	Elementary School Science Project—University of California	Completed
7.	Elementary School Science Project—University of Illinois (Atkin)	Completed
8.	TV Program for Mathematics Teachers	Completed
9.	Syracuse Webster Mathematics Projects (Madison)	Completed
**10.	Elementary Science Study (ESS)	Completed
**11.	Anthropology Curriculum Study Project (ACSP)	Completed
**12.	Science-A Process Approach	Completed
13.	University of Illinois Committee on School Mathematics	Active
14.	MINNEMAST	Terminated

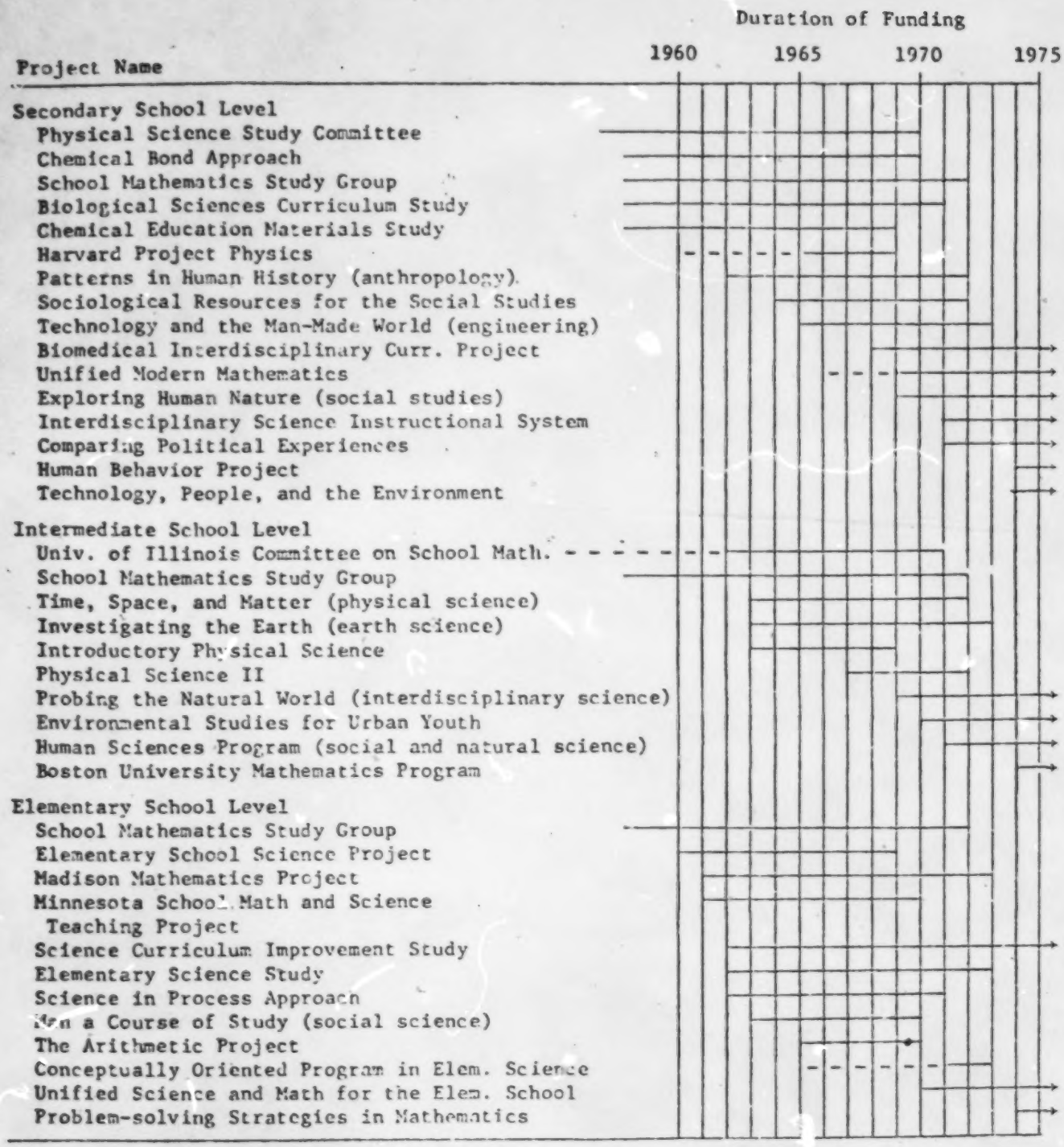
*15.	Science Curriculum Improvement Study (SCIS)	Completed
**16.	Earth Science Curriculum Project (ESCP)	Completed
17.	School Science Curriculum Project—University of Illinois (Sallinger)	Terminated
*18.	Man: A Course of Study (MACOS)	Completed
19.	Elementary School Science Improvement Project—University of Utah (Wood)	Terminated
20.	Secondary School Science Project (Time, Space, Matter)	Completed
**21.	Introductory Physical Science (IPS and PS II)	Completed
22.	Films for In-Service Education of Teachers of Elementary School Mathematics	Completed
23.	Quantitative Approach in Elementary School Science	Completed
24.	High School Course in Modern Coordinate Geometry	Completed
25.	High School Geography Project (HSGP)	Completed
26.	Sociological Resources for the Secondary Schools (SRSS)	Completed
27.	Engineering Concepts Curriculum Project-Man Made World	Completed
28.	Elementary Mathematics Projects (Arithmetic Project)	Completed
29.	Harvard Project Physics (PP)	Completed
30.	Portland Interdisciplinary Science Project	Completed
**31.	Intermediate Science Curriculum Study (ISCS)	Completed
32.	Improvement Project in Mathematics for Subcultural Groups (Gibb)	Completed
33.	Secondary School Mathematics Curriculum Improvement Study (SSMCIS)	Completed
34.	Computer Based Self-Instructional Course for Supplementary Training of Secondary School Teachers of Physics	Completed
35.	Environmental Studies for Urban Youth (ES)	Completed
*36.	Comparing Political Experiences (CPE)	Active
37.	Biomedical Interdisciplinary Curriculum Project (BICP)	Active
38.	Demonstration and Experimentation in Computer Training and Use in Secondary Schools (Dartmouth)	Completed
39.	Boston University Mathematics Program	Active
40.	Development of Computer Simulation Material (Huntington II)	Completed
41.	Development of Teacher Training Materials in Math (HCTTI)	Completed
42.	Experimental Teaching of Mathematics in Elementary School (Suppes)	Terminated
43.	Exploring Human Nature (EDC)	Active
44.	First Year Algebra with Application Project	Active
45.	Human Behavior Curriculum Project (APA)	Active
46.	Human Science Program (HSP)	Active
*47.	Individualized Science Instructional System (ISIS)	Active
48.	Mathematics Problem Solving Project	Active
49.	Mathematical Resources Project (Hoffer)	Active
50.	Outdoor Biology Instructional Strategies (OBIS)	Active
51.	Project for the Mathematical Development of Children	Active
52.	Technology-People-Environment (TPE)	Active
53.	United Science and Mathematics for Elementary Schools (USMES)	Active

* 5 Case Studies

** 9 projects selected for relatively extensive review

Pre-College Science Curriculum Activities of the National Science Foundation, report of Science Curriculum Review Team, May 1975, Vol. I, Findings.

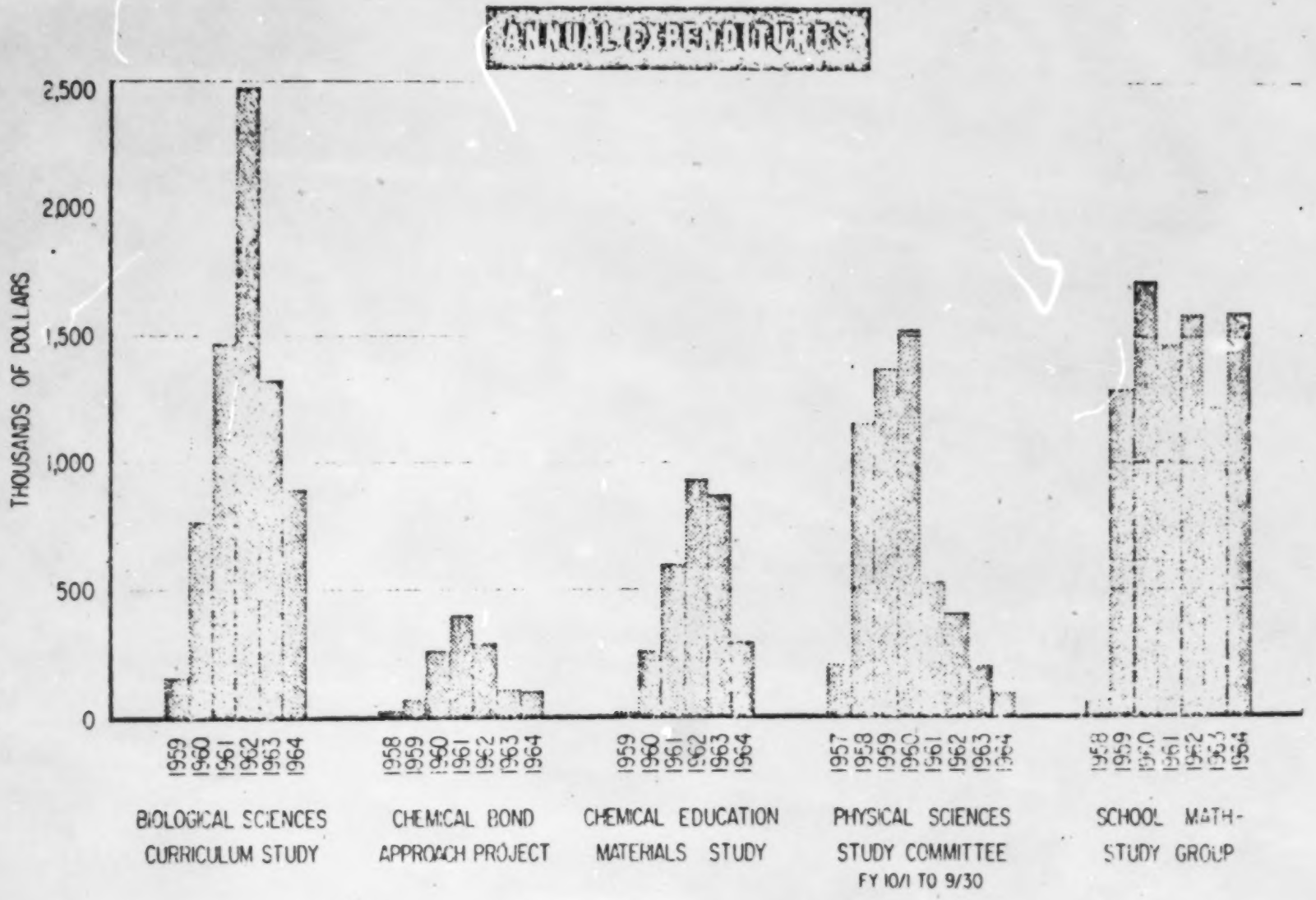
MAJOR NATIONAL CURRICULUM DEVELOPMENT PROJECTS OF THE NATIONAL SCIENCE FOUNDATION


Duration of Funding
Project Name
1960
1965
1970
1975
Secondary School Level
Physical Science Study Committee
Chemical Bond Approach
School Mathematics Study Group
Biological Sciences Curriculum Study
Chemical Education Materials Study
Harvard Project Physics
Patterns in Human History (anthropology)
Sociological Resources for the Social Studies
Technology and the Man-Made World (engineering)
Biomedical Interdisciplinary Curr. Project
Unified Modern Mathematics
Exploring Human Nature (social studies)
Interdisciplinary Science Instructional System
Comparing Political Experiences
Human Behavior Project
Technology, People, and the Environment
Intermediate School Level
Univ. of Illinois Committee on School Math.
School Mathematics Study Group
Time, Space, and Matter (physical science)
Investigating the Earth (earth science)
Introductory Physical Science
Physical Science II
Probing the Natural World (interdisciplinary science)
Environmental Studies for Urban Youth
Human Sciences Program (social and natural science)
Boston University Mathematics Program
Elementary School Level
School Mathematics Study Group
Elementary School Science Project
Madison Mathematics Project
Minnesota School Math and Science Teaching Project
Science Curriculum Improvement Study
Elementary Science Study
Science in Process Approach
Man a Course of Study (social science)
The Arithmetic Project
Conceptually Oriented Program in Elem. Science
Unified Science and Math for the Elem. School
Problem-solving Strategies in Mathematics

Key: — NSF Funding
--- Other Funding (Office of Education, foundations)

SOURCES: National Science Foundation, "Course Curriculum Improvement Projects," USGPO, 0-547-651, 1974, and "Pre-College Science Curriculum Activities of the National Science Foundation," Vol. II, pp. 171-176.

Chart 2


ANNUAL EXPENDITURES
THOUSANDS OF DOLLARS
2,500
2,000
1,500
1,000
500
0
1959 1960 1961 1962 1963 1964
1958 1959 1960 1961 1962 1963 1964
1959 1960 1961 1962 1963 1964
1957 1958 1959 1960 1961 1962 1963 1964
1958 1959 1960 1961 1962 1963 1964
BIOLOGICAL SCIENCES CURRICULUM STUDY
CHEMICAL BOND APPROACH PROJECT
CHEMICAL EDUCATION MATERIALS STUDY
PHYSICAL SCIENCES STUDY COMMITTEE
FY 10/1 TO 9/30
SCHOOL MATH-STUDY GROUP

Appendix B

Funding

TABLE I

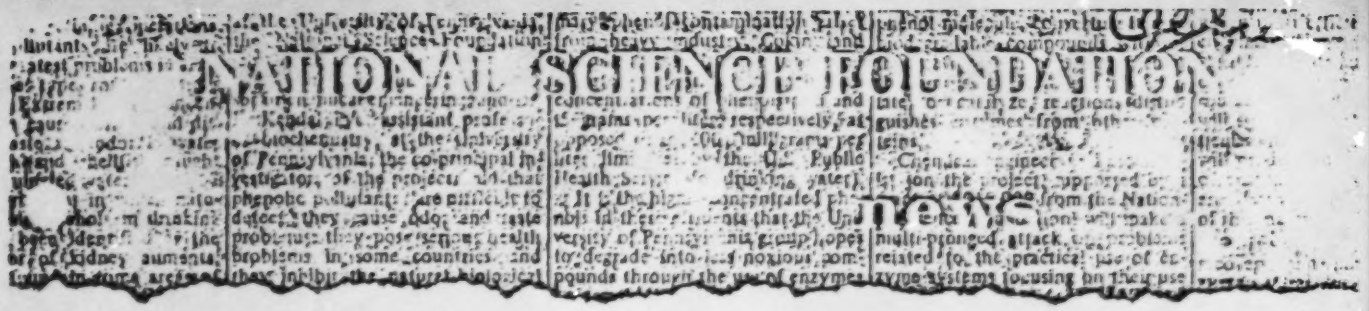
Public Support of Curriculum Development by Agency*

(In thousands of dollars)

Agency	Up to 1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Agency Totals
National Institute of Education	-	-	-	-	-	-	-	-	18,630	15,770	14,600	49,000
U.S. Office of Education	13,398	6,175	12,387	11,136	13,759	14,200	13,100	17,560	7,500	8,250	9,000	126,465
National Science Foundation	35,009	9,289	10,391	11,120	12,864	13,250	13,650	14,060	14,500	14,940	15,400	164,473
Other Federal Agencies	2,614	840	1,230	1,270	1,450	1,480	1,520	1,700	1,790	1,840	1,800	17,534
Private Foundations	5,320	1,700	2,500	2,580	2,900	3,000	2,800	2,500	1,900	1,800	1,750	28,750
Totals/yr.	56,341	18,004	26,508	26,106	30,973	31,930	31,070	35,820	44,320	42,600	42,550	426,222

* From Harbeck, Richard, "An Analysis of Public Involvement in Curriculum Development" (NIE, 1975, mi

Current Issues, Problems and Concerns in Curriculum Development, NIE, Jan. 15, 1976, p. 11.



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Home: (301) 593-0240

FOR RELEASE: Immediate
Mail: March 10, 1976
NSF PR76-25

NSF DETERMINES FUTURE SUPPORT OF PRE-COLLEGE SCIENCE CURRICULUM PROJECTS

The National Science Foundation announced today its decisions concerning continued support of 19 science curriculum development projects for elementary, junior, and senior high schools.

The 19 projects are the most recent of some 53 pre-college curriculum projects, supported by the Foundation over the last two decades, which have helped contribute to the upgrading of science education in the nation's schools. Subjects covered have included chemistry, physics, biology, mathematics, earth sciences, anthropology, behavioral and social sciences, geography, and engineering.

Eight of the 19 projects have been completed, or nearly so, and require little or no additional funds; three of the projects are planned for continuation; three will be continued, but reduced in scope; and five will not be continued.

The decisions are based on budgetary considerations, and the results of a review and evaluation by more than 70 outside experts, including scientists, educators, child development specialists, and informed representatives of the public. They are also based on information available

from third-party evaluations of selected projects, project reports, and reports of site visits.

Dr. H. Guyford Stever, Director of the National Science Foundation, said, "The review of the projects carried out by Dr. Harvey Averch, Acting Assistant Director for Science Education, and the decisions that we have reached, have fulfilled the directions of the Congress and the National Science Board, namely, that we take steps to put the total curriculum development program in line with the objectives of the Foundation in this area. These objectives include the development of broadly useful innovative course materials with adequate checks of needs, costs, and accomplishment of original goals. The Foundation will continue such evaluations of all curriculum projects supported."

Support for science curriculum development efforts is provided in accordance with the Congressional Act establishing NSF which directed the Foundation to initiate and support both basic research and programs to strengthen research potential and education in the sciences at all levels. The Foundation's effort to improve the teaching and learning of science is made with full awareness that the fundamental decision-making responsibility for the selection of curricula and course materials rests and must continue to rest with local school authorities.

Copies of the report "Panel Evaluation of 19 Pre-College Curriculum Development Projects, December 8-12, 1975," are currently available for inspection at the National Science Foundation, Room 531, 1800 G Street,N.W., Washington, D.C.

-END-

SEE ATTACHMENT FOR SUMMARY OF ACTIONS ON INDIVIDUAL NSF CURRICULUM PROJECTS.

SUMMARY OF ACTIONS

NSF PRE-COLLEGE CURRICULUM DEVELOPMENT PROJECTS

For each curriculum the final decision made was tailored to the specific nature of the situation. In general, however, the projects and divisions may be grouped into four classes, which are presented below, together with amplifying comments on each case:

1. Projects on which development is complete, or nearly so, and pending decisions relate primarily to publishing arrangements. These are:

   62 SAM - Sourcebook in Applied Mathematics - Minor modification. Publication arrangements remain to be reviewed.

   85 FYA - First Year Algebra - Minor revisions of materials will be necessary.

   1.500 AP - Arithmetic Project - This project is complete. The publishing arrangements remain to be approved.

   964 MMP - Modes in Math Project - This project is complete.

   67 PSIM - Problem Solving Instructional Material - This project is complete. Distribution arrangements remain to be decided.

   225 SB - Social Biology Films - This project is complete. Publishing arrangements remain to be approved.

   2.536 EHN - Exploring Human Nature - This project is complete. Major decisions regarding dissemination alternatives remain.

   5.699 262 TPE - Technology, People, Environment - This project is complete and has a publisher.

2. Projects with substantial further development funding required, regarding which serious criticisms have been raised by evaluators, and which will not be continued. These are projects which in the proposal stage appeared innovative and of high potential, but whose incremental benefits now do not seem proportional to their incremental costs. In most cases some additional funding will be required in order to complete some work in preparation to prepare documentation and histories of the projects.

-more-

Funds to

615 MPSP - Mathematical Problem Solving Project - Basic conceptual problems involving directions, goals, and management/organizational structure have contributed to relatively slow progress.

818 PMDC - Project for Mathematical Development of Children - Basic conceptual difficulties, high costs with relatively low output indicate further expenditure is not warranted.

592 MP78 - Mathematics Project for the 7th and 8th Grades - This is an expensive project that involves the production of new mathematics texts, a type of curriculum that the private sector may well support. Now well on the way toward development, there is high probability that a private publisher will complete the project. NSF will review and complete publication arrangements.

2.567 USMES - Unified Science and Mathematics for Elementary Schools - Work substantially accomplished will be completed, but new efforts will not be undertaken since the project appears to have completed its role within the currently projected set of modules. The course also seems to be as much a philosophy and method of teaching as it is a curriculum, and appears require relatively large amounts of teacher training.

6.76 HB - Human Behavior - This is a complex project with serious conceptual weaknesses. Panel reviewers felt that among the problems here were: lack of documented need for the specific modules being developed, the length and difficulty of materials, need for special teacher training, quality control. Little material had been produced and production is not contemplated.

3. Projects which require substantial additional funding to complete development, which are fundamentally sound, but which should be slowed down and substantially reduced in scope.

546 MRP - Mathematics Resources Project - Two resources have been completed and substantial work has been accomplished on two more. A fifth resource, dealing with statistics, will be prepared. Further work beyond this point, which was originally contemplated, will not be undertaken due to costs, apparent lack of marketability and other factors.

-more-

3.353 ISIS - Individualized Science Instructional System - This is a large and complex project which is producing an interdisciplinary, modular, science curriculum for high school students of average ability. The panel review identified several problems, but was basically favorable to the project. This project will be slowed down substantially, projection will be cut from 80 to 60-65 modules, and procedures will be implemented to improve quality control, insure parent-student-teacher input in preparation of materials, and third-party evaluations.

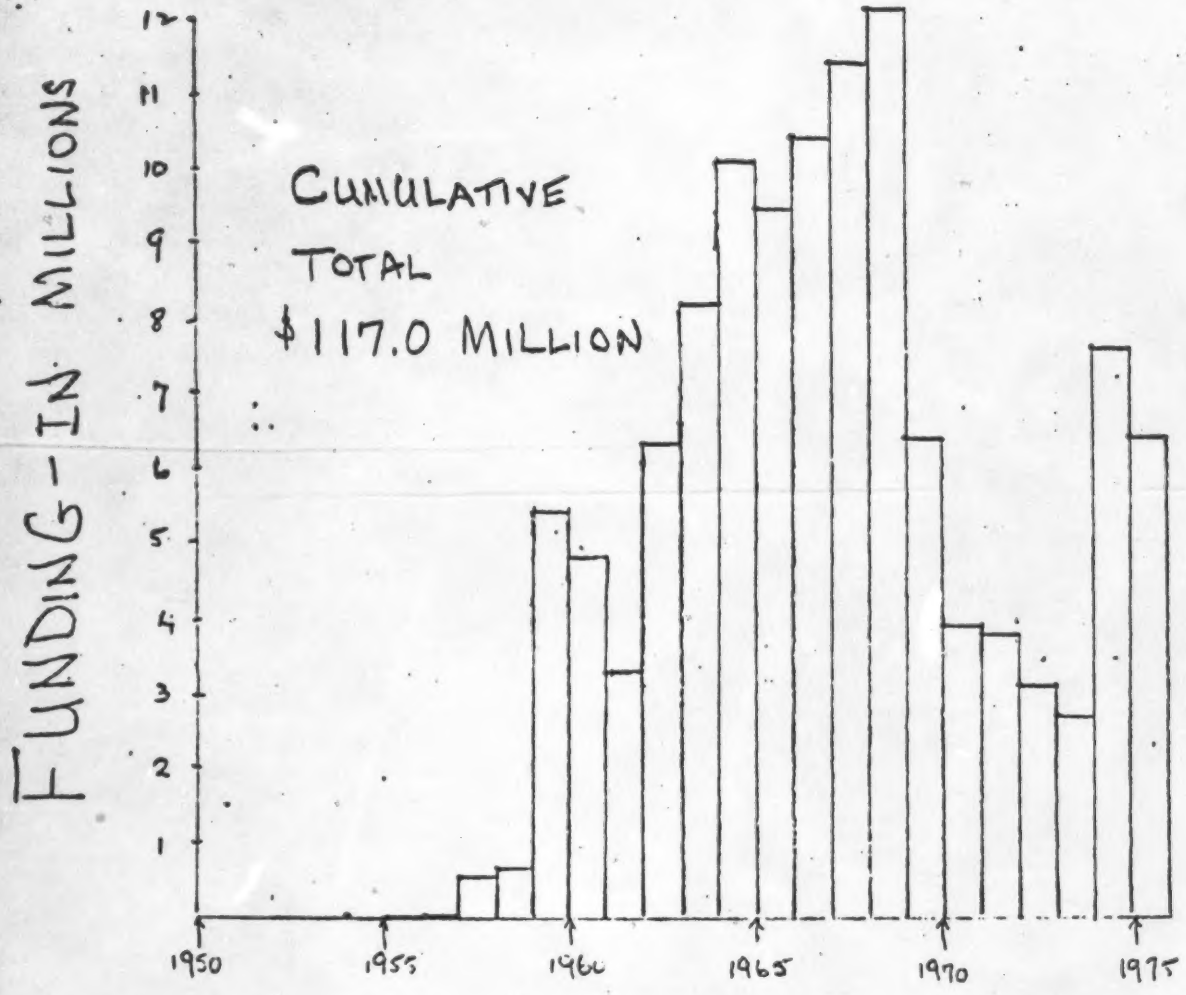
919 OBIS - Outdoor Biology Instructional Strategies - This is a large project producing materials for instruction in biology in non-classroom settings. The project was well reviewed, but is very expensive. This project will be continued for one additional year. This will allow completion of approximately half the materials originally contemplated. Dissemination arrangements remain to be formulated.

4. Projects requiring substantial additional development funding, which are fundamentally sound, and which will be completed substantially as originally planned. Minor modifications to accomodate criticisms developed in the review will be made. All of these will be subject to third-party evaluation before dissemination.

2.047 HSP - Human Sciences Project - This project is producing an interdisciplinary curriculum dealing with the biological, social, and behavioral sciences in grades 6-8. It is approximately 60 percent complete and received very favorable reviews. It will be completed substantially as originally planned.

1.262 CPE - Comparing Political Experiences - This project is producing a new political science curriculum for high school use, and is approximately 75 percent complete. Minor changes will be effected to deal with criticisms raised in the reviews. Dissemination alternatives need to be evaluated.

2.161 BICP - Biomedical Interdisciplinary Curriculum Project - This project is about 90 percent complete. Additional funding will be necessary to place all materials in final form. Dissemination arrangements remain to be negotiated.



FUNDING HISTORY OF PRE-COLLEGE CCI

FUNDING OF PRE-COLLEGE

COURSE AND CURRICULUM DEVELOPMENT ACTIVITIES*

Fiscal Year	Total Curriculum Development
1954	$ 1,725
1955	15,000
1956	15,770
1957	537,240
1958	646,925
1959	5,434,985
1960	4,744,605
1961	3,226,010
1962	6,368,993
1963	8,248,684
1964	10,034,110
1965	9,458,000
1966	10,391,000
1967	11,391,350
1968	12,242,921
1969	6,439,229
1970	3,908,000
1971	3,863,555
1972	3,099,543
1973	2,767,177
1974	7,686,415
1975	6,439,229
	$117,020,466

*Funding through S.P.I.S.E., CCI, CIDP, MIDS.

Data Source: 1954-1964 Status Report on CCI
1965-1966 CCI Records
1966-1975 CCI Annual Reports to NSB

Included: Needs assessment
CCI Development
Films & TV Development
Related evaluation
Curriculum Coordinating Groups (CSE/AAAS, CBMS, SSEC, etc.)

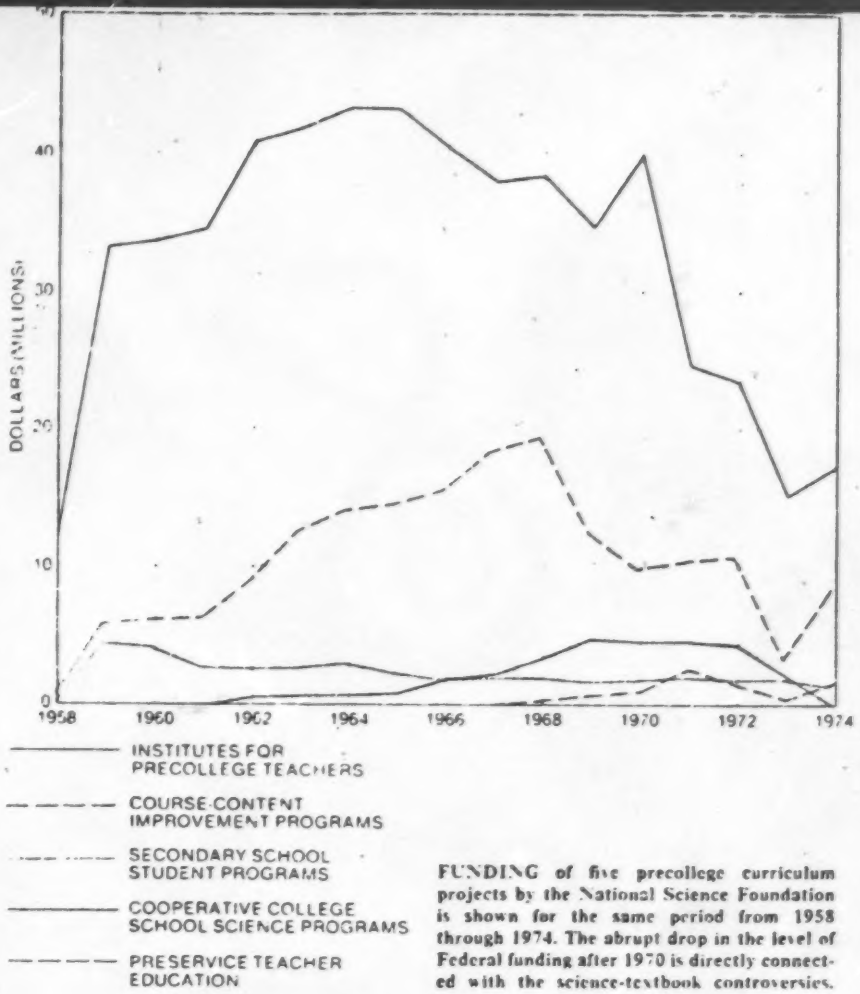
Source: NSF (Ray Hannopel)

dogmatic statements and to indicate the limits of scientific explanation. The creationists also attacked the National Science Foundation for its support of the BSCS materials. The theme of "a Federal takeover of education" emerged in full force during the MACOS disputes and during the 1975 Congressional hearings on the annual appropriation for the National Science Foundation. At that time Representative Conlan found that one way to arouse interest in MACOS among his Congressional colleagues was to describe the curriculum as an "insidious attempt to impose particular school courses ... on local school districts, using the power and financial resources of the Federal Government to set up a network of educator lobbyists to control education throughout America."

Textbook disputes are organized around demands for the increased participation of laymen in decisions about the school curriculum. The demands for local control have been stimulated by the decade-old ruling of the U.S. Supreme Court to the effect that decisions on obscenity and pornography were to be made locally. Textbook-watchers, who had been concerned with "smut in the schools," had watched the obscenity case with interest. They have used the Supreme Court ruling to back their argument that any issue impinging on local values, including how science is to be taught, should be judged within the community. [illegible] organizer in Texas who is active in anti-MACOS and pro-creationist protests throughout the country summarized the prevailing philosophy of the movement: "Unless people take an active voice in assisting the authorized units of government in a process of selecting textbooks, the selection will continue to deteriorate."

The public education system has been one of the last grass-roots institutions in America. School systems were traditionally decentralized, run by local school boards composed of elected nonprofessional citizens. Local control has gradually been eroded, however, through court decisions, through the reliance of schools on nonlocal funds, through the merging of school districts and through the trend toward professionalism. The curriculum in a public school today is guided more by national testing standards and college entrance requirements than by local values. The influence of individuals who expect to retain local control over educational policy is threatened by the growing power of statewide curriculum committees and by the increasingly professional departments of education. Federally funded programs devised by professionals are an additional threat.

The decline of local control has been a major source of tension in the controversies over ethnic balance and the busing of students as well as in the controversies over curricula and textbooks. Hence when textbook-watchers reject professional control of the curricula that influence their children, they can count on support from diverse groups ranging from the "radical right" to the "new left," all concerned with Government infringement on local powers and all sympathetic to any movement that seeks to increase individual political activity.



FUNDING of five precollege curriculum projects by the National Science Foundation is shown for the same period from 1958 through 1974. The abrupt drop in the level of Federal funding after 1970 is directly connected with the science-textbook controversies.

Demands for increased nonprofessional participation in curriculum decisions raise difficult practical questions. Does the state have a responsibility to require that certain textbooks be used in all classes? What kinds of constraints or standards can be imposed to balance academic interests with local and individual religious concerns? What happens if local values deny students access to widely accepted knowledge and wisdom?

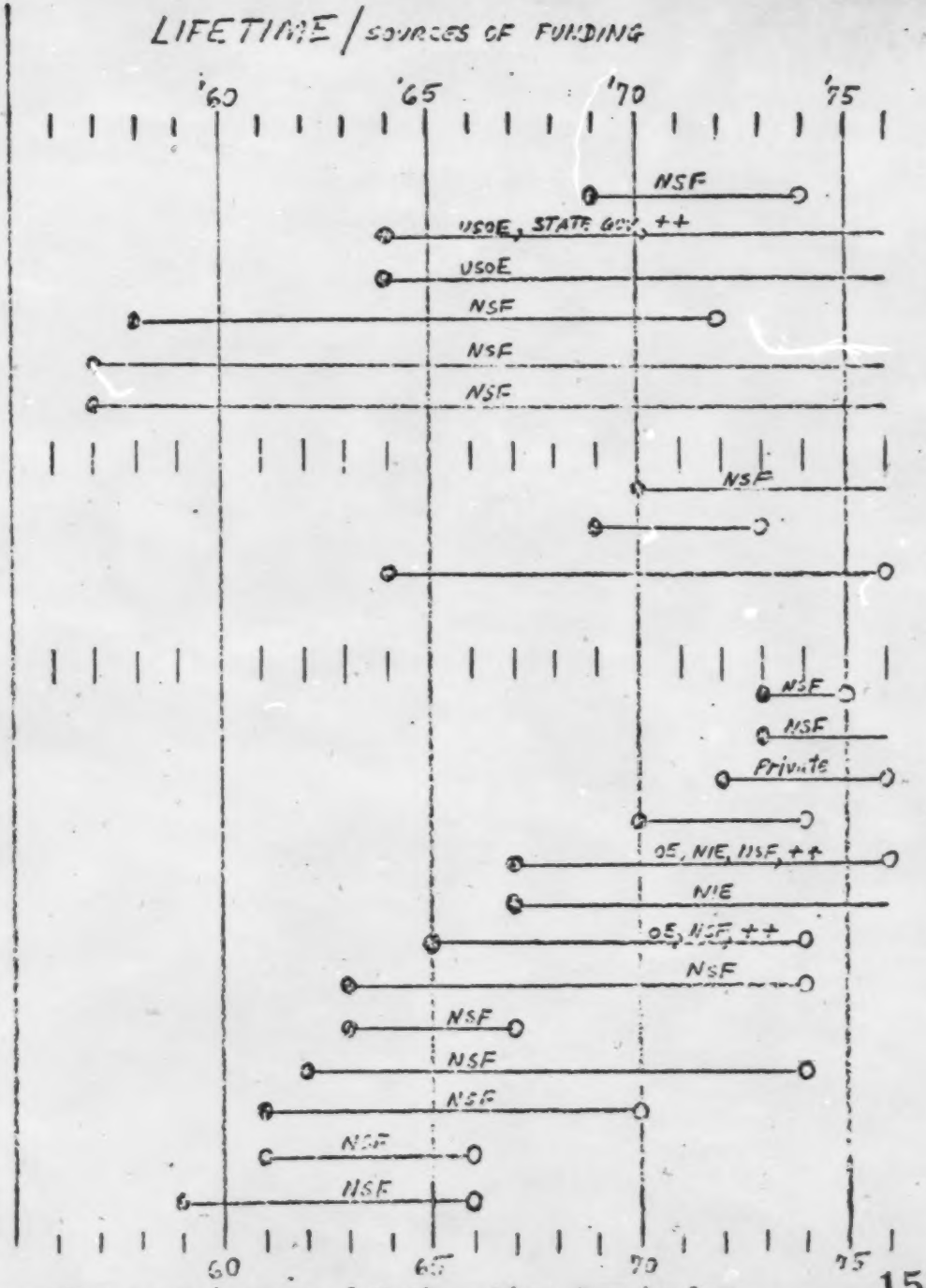
From the professional perspective designing a school curriculum is a technical enterprise that is best organized by experts, so that the curricula will provide the student with the best available information. From a local perspective, however, public education also transmits values and beliefs. Since such values and beliefs are very much family matters, parents must be involved. Clearly science education is no longer exempt from that perspective.

The third theme in the textbook controversies is a defensiveness toward the egalitarian, pluralistic processes that operate outside science, processes that lean heavily on the notion that there are two sides to every question and that each side should be treated fairly and given equal time.

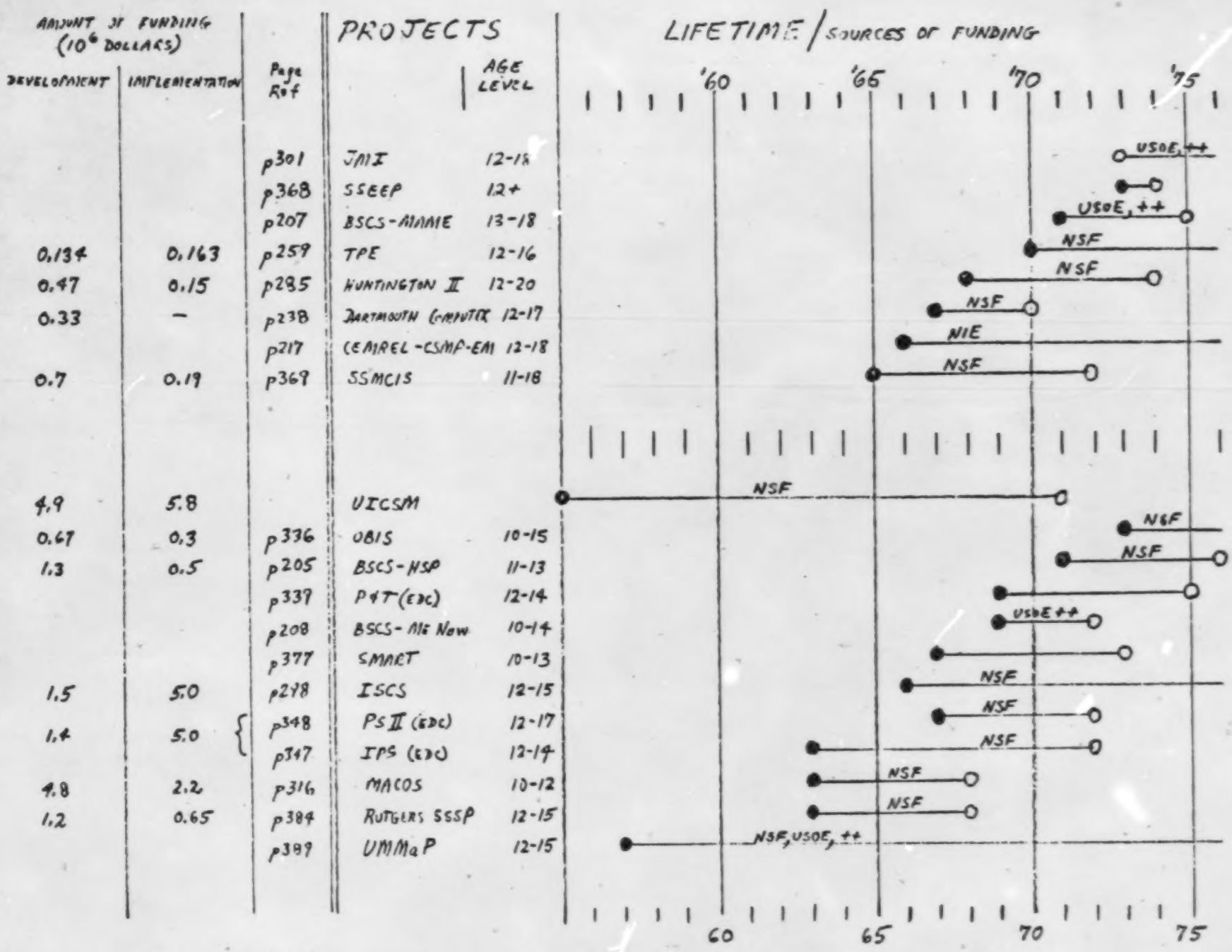
In January, 1973, Henry M. Morris, Jr., the director of the Institute for Creation Research, wrote to the director of the BSCS project and challenged him to a public debate. The debate would take up the statement: "Resolved, that the special-creation model of the history of the earth and its inhabitants is more effective in the correlation and prediction of scientific data than is the evolution model." Morris proposed that the winner of the debate would be determined by the applause from the audience. According to Morris, the issue was one of free public choice, of equality and of fairness. Creationists argue that since the biblical account of the origin of man and other living things is scientifically valid, it deserves equal time with the concept of evolution. Whenever there are two equally valid hypotheses, it is only fair that students be exposed to both of them and be allowed to choose for themselves.

The modern concept of equal time originated with the Fairness Doctrine of the Federal Communications Commission, which states that broadcasters are responsible for affording a "reasonable opportunity for the presentation of contrasting view-

AMOUNT OF FUNDING (10^6 DOLLARS)			PROJECTS	
DEVELOPMENT	IMPLEMENTATION	Page Ref.		AGE LEVEL
0.9	0.8	p270	ES	5-20
		p335	TETE	3-20
		p198	ANTH. CURR PROJ	5-17
14.4	2.26	p361	SMSG	5-18
		p212	BCME	5-19
1.1	2.5	p314	MADISON MATH	7-16
2.6	1.3	p387	USMES	6-14
		p134	ABMB	4-14
		p220	IS	5-14
7.6	4.1	p255	ESS	
0.4		p275	SWRL-ENC	5-6
0.47	0.002	p356	PMDC	5-8
		p204	BSCS-ESSP	5-11
		p355	PAIT	5-7
		p241	DACP	5-11
		p216	CEMREL-CSDP	6-12
		p229	COPES	5-13
2.3	4.9	p362	MMS S-MM	5-12
0.1	0	p254	ESSP (Mod. St)	6-7
4.3	6.7	p264	SCIS	5-12
5.0	0.7	p323	MINNEMAST	5-9
0.6	0.006	p388	UICSM (U. Ill.)	11-14
0.7	0.036	p253	ESCP (U. Cal)	7-13



151 Prepared by Joseph Dasbach from information in Science and Mathematics Curriculum Developments Internationally, 1956-1974, University of Maryland, 1975


AMOUNT OF FUNDING (10^6 DOLLARS)
DEVELOPMENT
IMPLEMENTATION
Page Ref
PROJECTS
AGE LEVEL
LIFETIME / SOURCES OF FUNDING
'60
'65
'70
'75
0.134
0.163
p301
JMI
12-18
USOE, ++
p368
SSEEP
12+
p207
BSCS-MMME
13-18
USOE, ++
p259
TPE
12-16
NSF
0.47
0.15
p285
HUNTINGTON II
12-20
NSF
0.33
—
p238
DARTMOUTH (MINUTE
12-17
NSF
p217
CEMREL-CSMP-EM
12-18
NIE
0.7
0.19
p369
SSMCIS
11-18
NSF
4.9
5.8
UICSM
NSF
0.67
0.3
p336
OBIS
10-15
NSF
1.3
0.5
p205
BSCS-HSP
11-13
NSF
p339
P&T (EDC)
12-14
p208
BSCS-Ms New
10-14
USOE ++
p377
SMART
10-13
1.5
5.0
p298
ISCS
12-15
NSF
1.4
5.0
p348
PS II (EDC)
12-17
NSF
p347
IPS (EDC)
12-14
NSF
4.8
2.2
p316
MACOS
10-12
NSF
1.2
0.65
p384
RUTGERS SSSP
12-15
NSF
p389
UMMaP
12-15
NSF, USOE, ++
60
65
70
75

AMOUNT OF FUNDING (10^6 DOLLARS)			PROJECTS		LIFETIME / SOURCES OF FUNDING
DEVELOPMENT	IMPLEMENTATION	Page Ref		AGE LEVEL	
1.3	0.057	p283	CPE	17-18	NSF
2.4	0.16	p291	ISIS	14-18	NSF
			BIOTECH	14-20	
			SAMMESS	16-18	USOE
		p297	IAC	16-18	
2.5	0.15	p279	EIIN (CDC)	16-18	NSF
		p206	BSCS ENV. MOD	14-17	USOE, NIE
		p294	IRA	14-15	USOE, NIE, ++
1.85	0.16	p210	BICP	16-18	
0.144	0.003	p352	PORTLAND PROJ	14-17	NSF
		p197	APB	14-18	USOE
2.0	3.0	p258	ECCP-MMW	15-18	NSF
2.5	1.8	p371	SRSS	16-19	NSF
0.9 NSF	4.7 NSF ?	p359	PROJ. PHYSICS	16-20	NSF, USOE
0.137	0	p332	MOD. COORD. GEOM.	15	NSF
3.5	0.7	p245	ESCP	13-18	NSF
2.3	1.9	p282	IISGP	11,17	NSF
10.4 ?	9.4 ?	p203	BSCS	-18	NSF
2.6	4.6	p221	CHEM STUDY	16-18	NSF
1.2	2.3	p220	CBA	16,18	NSF
5.3 ?	6.8 ?	p349	PSSC	16-17	NSF + ?

'60 '65 '70 '75

Table 5

SUPPORT OF EDUCATION IN THE SCIENCES, FY 1958-FY 1974

Obligations by Fiscal Year
($000)

	Program Category	FY 1958	FY 1959	FY 1960	FY 1961	FY 1962	FY 1963	FY 1964	FY 1965	FY 1966	FY 1967	FY 1968	FY 1969	FY 1970	FY 1971	FY 1972	FY 1973	FY 1974
1	Fellowships & Traineeships	$5,682	$13,073	$11,191	$13,139	$16,800	$21,678	$30,105	$40,224	$44,487	$45,874	$46,057	$39,811	$41,147	$35,407	$24,340	$15,108	$12,499
2	Institutes - Pre-College Teachers	12,232	31,288	33,775	38,500	40,876	41,901	43,247	41,196	40,531	37,929	38,328	34,713	39,868	28,525	29,373	15,128	
3	Cooperative College-School Science Programs	—0—	—0—	—0—	—0—	521	751	721	839	1,957	2,213	3,387	4,821	4,654	4,530	4,355	2,020	17,143
4	Science Activities by College-University Teachers	166	2,391	2,339	2,647	2,374	2,559	3,714	4,094	2,983	3,998	3,986	797	1,230	4,577	3,182	3,823	3,711
5	Undergraduate Student Programs	—0—	1,692	2,871	1,188	4,171	5,878	6,052	5,479	6,583	4,734	4,142	3,716	3,817	5,418	5,757	3,228	3,755
6	Secondary School Student Programs	389	4,843	4,458	3,950	2,898	2,932	3,198	2,554	1,973	2,070	2,067	1,685	1,911	2,051	1,938	1,955	1,375
7	Course Content Improvement Programs	835	6,010	6,299	6,411	8,990	12,632	13,976	14,552	15,564	18,355	19,352	12,440	9,840	10,314	10,698	3,311	2,261
8	Equipment for Undergraduate Instruction	—0—	—0—	—0—	—0—	5,019	7,734	8,650	8,205	7,736	4,906	4,338	4,498	4,167	—0—	2,881	1,578	1,240
9	Special Advanced Science Education	—0—	25	117	127	1,406	2,753	1,568	1,353	—0—	—0—	—0—	1,309	1,296	1,521	2,253	1,385	1,570
10	Special Projects	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	2,491	1,868	1,817	2,210	1,469	—0—	—0—	— —
11	Pre-Service Teacher Education	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	370	679	993	2,635	1,510	367	1,370
12	College Science Improvement Program	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	2,464	8,624	8,764	6,829	5,185	9,067	5,129	2,472
13	Computer Innovation in Education	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	8,372	6,218	7,432
14	Research & Problem Assessment	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	2,259
		$19,304	$61,290	$61,139	$61,442	$81,257	$99,771	$111,231	$120,415	$124,305	$125,824	$134,456	$115,207	$120,180	$99,812	$93,728	$61,328	$57,447

Carried under Item 4
Formerly carried under Item 1
Includes Tech Ed
Carried under Computing Activities prior to FY 1974 budget submission
Source: NSF Institutional Grants of Appropriations, The Congress, Fiscal Years 1968 through 1976. Totals may not add due to rounding

Project Description

As described to the National Science Board in an August 8, 1963 memorandum, "This project is part of a comprehensive plan for developing a carefully integrated sequential social science-humanities program for elementary and secondary schools".[1]

A primary emphasis was on producing ethnographic film studies to deal with the questions: What is human about human beings? How did we get that way? How can we be made more so? The curriculum was designed to introduce organizing ideas early and restate them frequently by the use of films of people in other, and apparently quite different cultures. Students were to be encouraged to learn to use anthropological and enthnographic methods and materials.

[1] The secondary schools curriculum development effort was later dropped.

Table 1.—NSF Grant Funds Awarded for Development of MACOS Curriculum and Evaluation, Fiscal Years 1963-75

Purpose and Fiscal Year	Requested	Awarded
Development		
1963	195,000	195,420
1964	618,315	513,360
1965	4,848,206	300,000
1966	—	1,200,000
1967	2,400,000	1,738,000
1968	1,460,334	430,000
1969	566,640	270,000
1970	527,005	150,000
Total	10,810,500	4,797,380[2]
Evaluation		
1970	14,377	14,000
1972	463,581	49,400[3]
1974	595,160	262,600[4]
Total	1,073,118	326,000
History	57,359	44,700

[2] Educational Services, Inc., Education Development Center, Inc.
[3] Washington School of Psychiatry, Washington, D.C.
[4] Antioch College, Yellow Springs, Ohio

Table 2.—NSF Grant Funds Requested and Awarded for Implementation of MACOS Development, Fiscal Years 1967-75

Fiscal Year	ESI or EDC[1]		Other Organizations	
	Requested	Awarded	Requested	Awarded
1967	35,538	35,500	—	—
1968	—	—	—	—
1969	13,250	11,000	626,000	445,000
1970	—	—	752,000	445,000
1971	—	—	471,000	387,000
1972	—	—	335,000	196,000
1973	—	—	NA	152,000
1974	331,000	25,000	NA	260,000
1975	15,000	10,000	245,000	200,000
Total	394,788	81,500	2,429,000	2,085,000

[1] Educational Services Incorporated, Education Development Center, Inc.
NA—Not available.
Between FY 1967 and 1975, requests from EDC for $313,000 and from other organizations for $1,241,634 were declined.
Source: Material supplied by Office of Assistant Director, Education, NSF, 4/25/75.

Pre-College, Vol. II, NSF.

minicourses in real-world classroom settings. Although they are not involved in a systematic evaluation of each minicourse, the independent centers are providing valuable feedback to the ISIS staff because they give a sneak preview of what can happen when ISIS materials are used by students and teachers in schools that are less tightly linked to the ISIS project.

Funding History

Grant	Award Date	Expiration Date	Award Amount
GW-7645*..	9 29 72	6 30 74	$290,000
Amendments:			
1	3 5 73	6 30 74	55,000
2	6 8 73	6 30 74	60,000
3	8 17 73	6 30 74	772,700
4 (No cost extension of expiration date to 9 30 74)			905
5	6 28 74	9 30 76	1,694,905
6	12 5 74	3 31 77	480,500
Total ..			$3,353,105

* New NSF-74-10-00.

Description and Objectives of the Project

ISIS will consist of approximately 80 short, essentially independent modules or minicourses, each requiring 2-3 weeks of classroom time. Each module will deal with a specific topic by presenting, in an interdisciplinary manner, the appropriate concepts from biology, chemistry, and physics. Pertinent information from the social sciences is incorporated in units that deal with the social implications of science and technology. Mathematics is included when necessary. For each module, "excursions" are developed which permit the student to probe into some of the more complex aspects of the topic. In an effort to keep down the equipment costs for schools adopting ISIS, the laboratory work makes use of materials and apparatus normally available in high school science labs. Guidance in implementing ISIS under a variety of situations is provided by an instructional management scheme.

Short- and long-range goals of the project are:

- Elimination of the unnatural barriers between scientific disciplines in an effort to provide the student with a better understanding of science.
- Development of materials which will (a) motivate students and provide them with sufficient knowledge to be scientifically literate and (b) permit more capable students to select and attain more advanced instructional goals.
- Formulation of a model which, hopefully, will promote changes in other subject-matter disciplines and, eventually, in the structure of the secondary school system.

Narrative History of Project Development

Under a grant dated June 23, 1971, NSF provided support for a conference held at Callaway Gardens, Georgia in October 1971 which brought together 34 experts to explore the feasibility of a new approach to high school science. This conference was proposed by Dr. Ernest Burkman of Florida State University and was supported under NSF Grant GW-6799 at a level of $10,600.

The persons attending the conference represented a broad range of experience in science and school instructional materials development. There were one or more university chemists, physicists, biologists, physicians, and economists. There were several people who had played roles in the development of PSSC physics, the CHEM Study, BSCS biology, ECCP engineering, ISCS junior high science and AAAS and QS elementary school science. Every branch of the teaching profession was represented including classroom teachers, science supervisors, school administrators, professors of science ducation and learning theorists. There was also representation from various professional organizations such as National Science Teachers Association, Social Science Education Consortium, Council on Physics Education, the American Institute for the Biological Sciences, and the AAAS Commission on Science Education.

The conference participants cited what they felt was considerable evidence for the inability of the then current science programs to meet the needs of today's society, today's schools, and today's students. They felt that:

- Many high school students were complain-

termination date of the exclusive rights of Rand McNally to publish SCIS materials.

The funding history for the SCIS project is given below.

SCIS FUNDING HISTORY

Grant	Award Date	Expiration Date	Award Amount
GE-600 (Univ. of Md.)	10/26/62	8/31/63	$40,250
GE-2914 (Berkeley)	9/23/63	8/31/64	99,480
Amendments to GE-2914			
1	6/18/64	6/15/65	75,000
2	8/25/64	6/15/65	154,300
3	6/30/65	10/31/65	199,910
4	10/1/65	6/30/67	300,000
5	9/13/66	6/30/67	552,000
6	6/29/67	9/30/70	176,000
7	1/12/68	9/30/68	635,000
8	6/28/68	9/30/69	625,000
9	6/30/69	9/30/71	1,171,000
10	6/29/71	6/30/73	138,455
11	6/26/72	6/30/73	160,000
12 (Extension of expiration date to September 30, 1974)			0
13 (Extension of expiration date to December 31, 1977)			0
Total			$4,326,395

Description of the SCIS Materials

Organization of Materials

The SCIS program consitst of 13 units, six units for a physical science sequence, six for a life science sequence, and one unit, subsequently, dropped, designed especially for kindergarten. The unity of the physical science sequence derives from fundamental concepts of change and interaction. The six basic physical science units—*Material Objects, Interaction and Systems, Subsystems and Variables, Relative Position and Motion, Energy Sources, and Models: Electric and Magnetic Interactions*—are designed to introduce and develop the concepts considered necessary for scientific literacy. In the life science sequence the units focus on organism-environment interaction. The six basic life science units—*Organisms, Life Cycles, Populations, Environments, Communities, and Ecosystems*—make use of many scientific concepts, but focus on the special considerations appropriate to the study of life. The Ecosystems unit attempts to synthesize children's investigations in physical and life science. The kindergarten unit, *Beginnings* was designed to develop children's powers of observation, discrimination, and description.

The following table shows the seven levels of the SCIS program along with the concepts introduced in each unit. Either the physical or life science program may be used independently. Within the physical or life science programs, the units are designed to be sequentially presented, rather than as independent modules or components. Each sequence of the six elementary units roughly corresponds to the 1-6 grade level sequence.

Format of Materials

The SCIS materials reach the classroom in the form of kits. The kits are designed to simplify and make convenient the use, storage, and re-use of the required equipment and supplies. Each kit is packaged for a teacher and 32 children and contains all of the materials needed except standard classroom supplies, such as crayons and scissors, and the fresh-water organisms which are sent separately when requested by the teacher. Each unit contains a teacher's guide and a student manual. The teacher's guides include the following:

1. An explanation of the conceptual framework for SCIS.
2. An overview of the particular unit or sequence.
3. Suggestions for the teacher—explanation of the learning cycle, exploration/invention/discovery; how to implement the learning cycle; use of discussions, questions and feedback; the student manual; language development; and optional activities.
4. Design and use of the kit.
5. Major parts of the unit—series of chapters are combined to form parts of the unit. Preceding each series of chapters there is a list of objectives for that part of the unit, background information, an overview, and how the student manual can be used.
6. For each chapter, learning objectives, teaching materials needed, advance preparation required, teaching suggestions, and optional activities are described or noted.